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GENERAL DISCUSSION ON PROGRESS IN THE IMPLEMENTATION OF AGENDA 21, FOCUSING ON CROSS-SECTORAL COMPONENTS OF AGENDA 21 AND THE CRITICAL ELEMENTS OF SUSTAINABILITY

Demographic dynamics and sustainability

Report of the Secretary-General

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INTRODUCTION

1. The present document reports on progress in the implementation of the aims set out in chapter 5 of Agenda 21 (Demographic dynamics and sustainability) 1/ and presents a set of recommendations for action. The report was prepared by the United Nations Population Fund (UNFPA) as task manager for chapter 5 of Agenda 21, in consultation with the United Nations Secretariat, in accordance with arrangements agreed to by the Inter-Agency Committee on Sustainable Development at its fourth session. It is the result of consultations and information exchanges between designated focal points in 19 United Nations agencies, governmental officials and a number of other institutions and individuals.

2. The implications for the environment and sustainable development of a rapidly rising world population and other demographic trends, along with consumption and production patterns, have been discussed at international forums for at least two decades. Only in recent years, however, has the international community agreed on a comprehensive series of common objectives and action recommendations for dealing with these issues.

3. A beginning was made with the decisions taken at the 1972 United Nations Conference on the Human Environment, held in Stockholm. At the United Nations population conferences held in 1974 and 1984, recommendations on environment and development issues were included in the outcomes but would not appear to have been given high priority in subsequent years.

4. An important milestone was passed in 1987 with the publication of Our Common Future, 2/ the report of the World Commission on Environment and Development, which observed that sustainable development could only be achieved if population size and growth were in harmony with the changing productive potential of the ecosystem.

5. The International Forum on Population in the Twenty-First Century, which in 1989 adopted the Amsterdam Declaration on a Better Life for Future Generations, 3/ acknowledged the inextricable linkages between population, resources and the environment and the need to bring about a sustainable relationship between human numbers, resources and development.

6. The 1990 report of the South Commission 4/ found that current population trends, if not modified, would have negative implications for the South's ability to achieve development and environmental security in the twenty-first century.

7. Finally, in 1992 the United Nations Conference on Environment and Development adopted Agenda 21. Chapter 5 addressed the connections between demographic dynamics and sustainability and provided the most extensive set of recommendations on these issues ever agreed by the international community.

8. The chapter contains three programme areas:

(a) Developing and disseminating knowledge concerning the links between demographic trends and sustainable development;

(b) Formulating integrated national policies for environment and development, taking into account demographic trends and factors;

(c) Implementing integrated environment and development programmes at the local level, taking into account demographic trends and factors.

9. The new salience given to the population/environment/development linkage in chapter 5 of Agenda 21 was carried forward into the Programme of Action adopted by the International Conference on Population and Development, held in September 1994 in Cairo. 5/

10. During preparations for the Conference, a new approach for dealing with population issues evolved, based on the global community's growing appreciation of the linkages between human development, environmental protection and the empowerment of women.

11. According to the Preamble of the Programme of Action, the 1994 conference

> was explicitly given a broader mandate on development issues than previous population conferences, reflecting the growing awareness that population, poverty, patterns of production and consumption and the environment are so closely interconnected that none of them can be considered in isolation. 6/

12. The Programme of Action covers the period until 2015. It reflects the conviction that, to improve people's quality of life and health, developing countries need sustained economic growth within the context of sustainable development, and there must be investments in health and education, especially for girls. The Programme of Action strongly maintains that there can be no sustainable development without the full and equal participation of women in all aspects of development planning and programming. It contains goals and recommendations for the reduction of infant, child and maternal mortality; advances in education; and universal access to reproductive health care, including family planning, by the year 2015. The Programme of Action recognizes that investments in health and education are essential if population stabilization and a balance between population and resources are to be achieved.

13. The Programme of Action is thus about the improvement of the quality of life of all members of the human family. It is about broader choice. It is about better health and better education: it is about strengthening the family as the basic unity of society; and it is about equity and equality for women. It is also about the prospects for sustained and sustainable development and about the sort of future coming generations will inherit.

14. Chapter III of the Programme of Action calls on Governments, with the support of the international community and regional and subregional organizations, to formulate and implement population policies and programmes to support the objectives and actions agreed upon in Agenda 21 and other conferences and other international environmental agreements, taking into account the common but differentiated responsibilities reflected in these

agreements. The chapter has three programme areas: integrating population and development strategies; population, sustained economic growth and poverty; and population and environment.

15. Chapter 5 of Agenda 21 and the Programme of Action together form the most compelling and comprehensive account so far of what needs to be done about the interface between population, environment and sustainable development. The two documents refer to and reinforce each other.

16. In this report, therefore, the activities outlined in the relevant sections of Agenda 21 and the Programme of Action are seen as parts of a continuous process. While Agenda 21 contains the initial statement of intent, the Programme of Action may be seen in part as a reaffirmation and a follow-up to Agenda 21 and a historic breakthrough for the population and development component of sustainable development.

I. GENERAL OVERVIEW

17. The current demographic situation displays a world of considerable disparity at various levels. From the global point of view there are many encouraging signs. After having reached an average annual peak of 2.04 per cent in the years 1965-1970, world population growth declined steadily and is expected to reach a level of 1.57 per cent annually in the years 1990-1995, according to the United Nations median variant. Less encouraging, however, is the seemingly inexorable march of the population momentum which ensures that the number of people being added to the world's population is still rising and is now approaching 90 million annually. The annual increment is not likely to peak before 1998, after which the high number of youth in the developing world will allow it to decline only very slowly for some time to come.

18. At the regional level, the population growth picture becomes more varied (see the table below). After a decline during the first half of the 1980s, the population growth rate of the least developed countries actually increased during the second half of the decade. In some parts of sub-Saharan Africa the rate of growth has never ceased to increase, and at present growth levels the population of some of those countries (which are among the poorest) will double in about 20 years. In Central and South America the growth rate has decreased steadily as it did in the Caribbean until the mid-1970s, after which it began to increase (albeit very slowly). With one or two exceptions, however, all regions and subregions of the world are projected to have a declining growth rate in the future. Many industrialized countries are already experiencing negative growth rates and are expected to continue to do so.

Table. Annual rate of population growth, by region

(Percentage, medium variant)

Major area and region	1970-1975	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000	2000-2005	2005-2010	2010-2015
World total	1.96	1.73	1.73	1.73	1.57	1.49	1.37	1.29	1.20
More developed regions	0.81	0.67	0.56	0.58	0.40	0.32	0.25	0.21	0.18
Less developed regions	2.37	2.08	2.09	2.06	1.88	1.78	1.63	1.52	1.41
Least developed regions	2.47	2.57	2.44	2.55	2.82	2.74	2.52	.40	2.28
Africa	2.56	2.78	2.86	2.84	2.81	2.66	2.56	2.47	2.37
Asia	2.27	1.87	1.89	1.86	1.64	1.55	1.38	1.26	1.15
Europe	0.60	0.49	0.38	0.43	0.15	0.08	0.00	-0.03	-0.06
Latin America	2.44	2.28	2.11	1.97	1.84	1.67	1.50	1.34	1.20
North America	1.10	1.07	0.93	0.98	1.05	0.90	0.81	0.78	0.78
Oceania	2.09	1.13	1.50	1.55	1.54	1.42	1.31	1.24	1.18

Source: World Population Prospects: 1994 Revision (United Nations publication forthcoming).

19. The Programme of Action indicates that we have a choice as to how many people will inhabit the earth in the decades ahead. The choice is essentially between a world population in the year 2015 of 7.1 billion or of 7.8 billion, or somewhere in between. The difference between the high and the low projections for the year 2015 is 720 million, which is approximately the present population of Africa. In the year 2050 the difference between the high (11.9 billion) and the low (7.9 billion) projections is a staggering 4 billion, which is about 70 per cent of the present world population, whose impact on the environment is already causing great concern.

20. In many parts of the developing world, where people are facing the most difficult problems, considerable improvement has taken place during the past 25 years. Fertility levels and crude death rates have declined, and life expectancy at birth has increased by nearly 20 per cent, from 52 years in 1969 to 62 years today. Overall, the health of women and children is improving, and contraceptive prevalence has increased from around 14 per cent in 1960-1965 to around 57 per cent of women of reproductive age in 1994.

21. Considerable progress has been made in reducing both mortality and fertility rates. Mortality rates have improved in nearly all parts of the world, especially in Northern Africa, Western Asia and South America, where infant mortality rates were reduced by more than half. Mortality indicators show, however, that the gap between industrialized and developing countries has

widened during the past two decades. And in some areas of the developing world the positive trend of the 1970s has slowed and was even reversed in the 1980s, as the effects of the economic recession, the debt crisis, and structural adjustment programmes began to be felt.

22. In the developing countries the total fertility rate decreased from about 5.8 in the early 1970s to about 3.6 in the early 1990s. The greatest reduction has taken place in East and South-east Asia and Latin America and the Caribbean, and the least has occurred in sub-Saharan Africa, where in some countries the fertility rate has actually risen.

23. Few measures are more important to the success of population and development policies than those aimed at the emancipation and empowerment of women. Although progress has been made, various obstacles have combined to defeat the initiatives aimed at improving the status of women. They include certain traditional norms, low literacy rates and educational attainment among girls and women, low priority given to women's issues by policy and decision makers, and the relative weakness of institutions formed to advance the causes of women.

24. Most reports emphasized the erosion of the traditional family unit. Fewer marriages, increasing divorce rates, and rising numbers of female-headed households were mentioned in a large number of reports from all parts of the world. Changes to and the gradual erosion of traditional family structures and practices caused many developing countries to express concern over the number of elderly people who find themselves without care.

25. Migratory movements were mentioned in almost all national reports. The magnitude of international migration and of rural-to-urban and other forms of internal migration has reached unprecedented proportions. A highly visible trend recorded in almost all developing countries is the massive migration to one or two major cities. The reports identify five major causes of increasing urbanization, all of which are about the search for better living conditions: rural unemployment and underemployment; poor rural social services; lack of arable land; natural disasters, particularly drought; and civil unrest.

26. The reports collectively suggest that population policies and programmes contribute a great deal to socio-economic development and environmental preservation. They also confirm that a range of complementary sustainable development initiatives might greatly enhance the implementation of population programmes. The growing recognition of these symbiotic relationships is being gradually translated into policies, plans and programmes.

27. The integration of population concerns into environmental and sustainable development planning nevertheless poses some special challenges. Some of these relate to the planning process itself such as lack of clear lines of responsibility and lack of focus in the national development plan. Others include the difficulty involved in doing what to many is something entirely new - namely, integrating cross-sectoral issues into a sectorally based and structured planning system. Yet others stem from lack of data and trained staff.

28. In general the reports indicate that the developing countries in particular experience considerable difficulties in integrating population concerns into their development and environment planning. Resource constraints and institutional limitations quite clearly set limits to what can be achieved during any given period of time. Awareness of the links between population and sustainable development, however, is clearly growing in both the public and private sectors.

II. REVIEW OF PROGRESS

A. Country experiences

29. Nearly all of the countries that submitted national reports on the implementation of Agenda 21 referred to their national reports to the International Conference on Population and Development, in which they had discussed their implementation of chapter 5 of Agenda 21. The overview provided here and the accounts of activities at the national level therefore draw extensively on the national reports prepared for that Conference.

30. Of the 168 countries that submitted reports to the secretariat of the International Conference on Population and Development, 125 were from developing and 43 from industrialized countries.

31. The national reports contain little information about concrete activities and projects aimed at further exploration and greater clarification of the intricate relationships between demographic factors, sustainable development and the environment. They do provide, however, information about institutional developments and general policies and attitudes.

1. Developing countries

32. The accomplishments of the past two decades are the result of many factors, not the least of which is a pronounced change by many Governments from indifference to committed endorsement of population activities and policies. This has been given concrete expression in the formation, where none existed before, of central governmental institutions charged with the implementation of comprehensive population policies and programmes. As many as 98 per cent of the developing countries reported the existence of such institutions, of which 77 per cent dealt exclusively with population issues, either through a national population ccuncil or a ministry.

33. More attention is being paid to the need for integrating population concerns into national planning systems. Although in the past many countries included population variables in their five-year development plans, the reports reveal that the steps taken to integrate population issues into other levels of planning are of relatively recent origin in many countries.

34. Of the reports which addressed the issue, 94 per cent stated that population concerns were incorporated into the overall development plan of their respective countries. In the great majority of cases, however, the population

dimension was treated in very general terms. Only 17 per cent of the reports made clear that population was integrated in the sectoral planning processes, and only 8 per cent indicated that population issues had made it into local-level planning.

35. Several countries (for example, India and Argentina) have decentralized their planning systems to such an extent that population plans are almost entirely the prerogative of local administrations. Other countries have decentralized various elements of their population programmes.

36. Many countries indicated that, despite having a planning apparatus that facilitates the integration of population concerns into national planning, there is lack of functional integration. This is mainly attributed to lack of data and insufficient analysis of existing data, lack of satisfactory methodology for integration, lack of a critical mass of technical staff and of staff commitment among the line ministries and departments to carry out the tasks necessary for integration, and lack of resources. Of these, weaknesses in data collection, analysis and research capacity were particularly stressed.

37. The attention currently paid to the relationship between population and development sprang from a realization in many countries that population growth is outpacing socio-economic development and that a balance between the two has to be found. Low levels and rates of technological progress, combined with rapid population growth, have been placing severe strains on social and economic institutions and the carrying capacity of the natural environment.

38. The most frequently reported relationship (noted in 75 per cent of the reports) is between population growth and general socio-economic development, which includes rate of economic growth, general living standards, and equity. In several cases population growth and the attendant demands for social services, dwellings etc. exceed economic growth by a wide margin. In the national report of Lesotho, for example, it is stated that per capita income is likely to decrease significantly as a result of population growth because even if the Government succeeds in raising investment levels to generate more income and savings, the net effect will be overtaken by the sheer growth in the number of people requiring social and other services.

39. The linkage between population growth and social services was of concern to 63 per cent of the developing countries. Two African countries illustrate the concern expressed by many. In Botswana, population growth in the years 1971-1991 led to a doubling of primary school enrolment, straining the national education budget to its limits. In Burundi half-time schooling was introduced to cope with the growing demand for basic education.

40. The third most frequently mentioned issue, referred to in 57 per cent of the reports, was the linkage between population growth and natural resources/land use. The loss of arable land stood out as perhaps the most serious concern. Thus, in Lesotho between 1976 and 1994 arable land was reduced from 13 per cent to 9 per cent of total land. High population growth and more than a doubling of the population density (from 306 to 743 persons per square km) led to a drastic conversion of farmland into human settlements. Overgrazing and soil erosion also contributed to the loss of arable land.

41. The report from China provided another drastic example: rapid population growth had led to a continuous decrease in the per capita share of arable land. One third of the country's arable land was affected by soil erosion, with a loss of 5 billion tons of top soil every year.

42. Two types of links involving the environment are particularly stressed in the national reports. The first is that between production and the environment; the second is that between urban migration/population density and the environment. In 86 per cent of the reports from the developing countries, production and the environment were singled out. Production was usually cited as the cause of the depletion and/or degradation of natural resources and the pollution of land, water, and air. Both agricultural and industrial processes were included. In the report of the Philippines, urban industrial processing was blamed for the pollution of water and air.

43. The linkage between urban migration/population density and the environment was mentioned in 73 per cent of the reports. Very rarely was population density mentioned apart from urbanization, which suggests that in many cases population density is equated with urbanization. Some of the effects of urbanization on the environment were destruction of natural resources, pollution of adjacent rivers, and air and water pollution. The report of Bangladesh stated that the rapid increase in urban population was due mainly to the heavy flow of rural migrants to urban areas in search of work and the inability of the rural areas to absorb and sustain further population increase. The physical amenities of urban areas - e.g., sewerage, water supply, transportation, sanitation - were unable to cope with the large influx of population. Most of the urban and suburban areas were thus exposed to heavy pollution.

44. In 41 per cent of the reports reference was made to the link between population growth and its effects on the environment. According to the Nigerian report, the country's high population growth rate was leading to tolerable levels of the extraction of natural resources at an unacceptable level, thus defeating attempts to achieve sustainability.

45. Although the national reports reveal that many aspects of the links between population and development are not well understood, there was widespread agreement that population policies and programmes can have beneficial effects on development. Similarly, the reports generally recognize that population interventions will be more successful if they are complemented by a range of development policies and programmes. Many reports noted, for example, that investments in primary health care and improvements in the status and condition of women could have significant impact on total fertility rates. A large number of reports cited the results of research on the impact of female education on fertility rates.

46. Links between population and development are also perceived in terms of the overall cost of development initiatives. Certain low-income countries are beginning to look on population initiatives as cost-efficient means of promoting development. In the view of quite a few countries, the savings that resulted from population interventions were considered substantial because of their comparatively low cost.

47. Pollution of land, air and water, especially from production processes; soil erosion and land degradation; loss of biodiversity; and deforestation emerged from the reports as the most salient problems. Resolving them will require a better balance between population growth and distribution and the natural carrying capacity of the land.

2. Developed countries

48. Having completed the demographic transition, the developed countries are less concerned by overall population growth rates than by the age structure of their populations. Thus the relationship between ageing and social expenditures was mentioned in 79 per cent of the reports filed by 24 country members of the Organisation for Economic Cooperation and Development (OECD). According to the report of Japan, for example, the portion of its population aged above 65 years had increased from 5 per cent in 1950 to 12 per cent in 1990 and was expected to increase to 26 per cent by the year 2025.

49. Another prominent issue in many developed countries is the relationship between family policy, women in the workforce and fertility trends. The Austrian report provides a good example of the problems involved. As in many other developed countries, the fertility rate in Austria is below replacement level, and the decline in the rate is seen in part as being due to the increasing number of women who have joined the work force. The Government thus introduced policies meant to help women combine careers with raising families and distribute the burdens of house-keeping and child-raising more equitably between the sexes. Other developed countries have introduced similar policies.

50. Half of the reports from OECD countries mention the relationship between immigration and social unrest. Only a third referred to the relationship between environment and lifestyles/behaviour.

51. The link between production and environment was cited in 55 per cent of the reports. Although consumption is presumably part of this set of issues, only 25 per cent of reports referred to consumption as such. The report of Australia made the point that small populations with high consumption levels may have a greater impact on the environment than large populations with low consumption levels. The report of Germany argued that major responsibility for reducing global environmental damage lies with the developed countries, mainly because of their high rates of production and consumption.

52. The links between urban migration/population density and the environment were also mentioned in 55 per cent of the reports. The points made were much the same as those made by the developing countries - namely, that urbanization gives rise to waste disposal problems and pollution of various kinds and removes prime arable land from agricultural production.

3. Countries with economies in transition

53. Some of the concerns identified by the developed countries were shared by the countries with economies in transition - for example, the linkage between population ageing and social expenditures and the linkage between family policy, women in the workforce and fertility trends.

54. Two other linkages, reflecting the difficult economic changes taking place in these countries, were mentioned by 86 per cent of them: the links between economic performance and the well-being of the population, and between economic performance, employment opportunities and migration patterns.

55. The relationship between environmental degradation and public health also figured prominently. The report of Russia, for example, referred to the effects of industrial contamination of the environment on paediatric mortality and morbidity (especially childhood asthma). The reports of both Poland and Russia saw the health of their industrial workers as a function of levels of industrial pollution.

B. Major groups and non-governmental organizations

56. The recognition the non-governmental organization community received for its contributions to the United Nations Conference on Environment and Development process was translated into active and well organized participation in the preparatory process for the International Conference on Population and Development. Non-governmental organizations took part in all the sessions of the Preparatory Committee and in regional preparatory meetings. An NGO Planning Committee and its operating arm, the NGO Planning Committee Secretariat, arranged and facilitated the participation of non-governmental organizations in Cairo. Funding for these organizational activities was obtained from Governments, foundations, United Nations agencies and non-governmental organizations themselves. The number of non-governmental organization representatives on national delegations was higher than at any past United Nations conference. A total of 1,254, of which 153 were in consultative status with the Economic and Social Council, received accreditation from the United Nations to participate in the official proceedings, and more than 4,200 participants from 138 countries partook in Forum activities.

57. The Programme of Action in no small measure owes its overall advances to the determined efforts and influence of the non-governmental organizations. Women's health organizations were especially active in lobbying for a broader definition of reproductive health and measures aimed at the empowerment of women.

58. A rough division according to category of non-governmental organizations present in Cairo reveals that some 87 were environmental and some 320 were development. Others were more or less purely concerned with population, women, youth. These numbers indicate a solid increase in non-governmental organizations that include demographic factors in their activities, although their main focus is not on population.

59. In both developing and industrialized countries, many of these non-governmental organizations have significant programmes and projects in the field of population, environment and sustainable development. Suffice it to mention institutions such as the International Union for the Conservation of Nature (IUCN), the International Institute for Applied Systems Analysis (IIASA), the International Union for the Scientific Study of Population (IUSSP), the Sierra Club, the Audubon Society, the Environmental Defense Fund ... A more extensive account of the activities of non-governmental organizations in the field of population, environment, and sustainable development will be presented in the report on chapter 5 to the next session of the Commission.

III. FINANCE AND TECHNOLOGY

60. The delegations at the Conference reached a general consensus on the resources needed for an integrated programme for population and reproductive health - one that includes family planning and other reproductive health services, measures for preventing sexually transmitted diseases, HIV and AIDS, and population data, policy and research. Agreement was possible because the methods that generated the estimates were extensively reviewed by experts at the Preparatory Committee and inter-sessional meetings leading up to the Conference. This process resulted in resource projections significantly more advanced than those discussed in earlier international forums.

61. The Programme of Action estimates that about $17 billion will be required in the year 2000 from all sources - Governments, non-governmental organizations, the private sector, and the international community. This amount increases annually, reaching $21.7 billion by the year 2015.

62. These estimates suggest that globally about two thirds of the resources required in the developing countries will still come from national sources. They also suggest that by the year 2000 the annual support to population and reproductive health programmes by the international community needed to address national needs will be about $5.7 billion, rising in steps to about $7.2 billion in 2015. This compares to the present level of about $1 billion each to family planning and to other reproductive health programmes.

63. The magnitude and the rate of increase of the resources required vary substantially between and within different subregions of the world. The annual amount needed will have to increase rapidly in order to avoid delays in implementation, which would lead to higher costs later.

64. The greatest proportional increases in resources, both in the near term and over the next 20 years, will be needed in sub-Saharan Africa. It is there that the greatest investments in the development of vital institutional infrastructure will be required and where the constraints on domestic resources are most severe. External assistance to sub-Saharan African programmes will need to reach nearly $1.8 billion per year in the year 2000, as compared to roughly $200 million-$250 million per year in the early 1990s. Alone among the world subregions, the total annual resources required for sub-Saharan African programmes will nearly double between the year 2000 and the year 2015.

65. In the year 2000 it is estimated that the external assistance required in the Asia and Pacific region will exceed $2.9 billion and that external assistance requirements during the period 2000-2015 will remain fairly level, at about $2.8 billion-$2.9 billion per annum.

66. In the Latin American region the needs for external resources between 2000 and 2015 are expected to remain stable at the level of roughly $500 million a year, which is a much smaller share of total resources than in the case of Africa.

67. Levels of external assistance similar to those for Latin America will also be required in North Africa and Western Asia between 2000 and 2015.

68. External assistance to countries with economies in transition in Eastern Europe and the former Soviet Union will be necessary in order to stop and reverse the present deterioration of the primary health service infrastructure so as to facilitate the transformation of their programmes for population and reproductive health into ones that include quality family-planning information and services.

69. These resource estimates do not include the cost of implementing some of the specific goals included in the Programme of Action, such as primary education for all and reducing maternal and child mortality rates.

70. The Secretary-General of the United Nations has assigned to the Executive Director of UNFPA the task of coordinating consultations with various bodies of the United Nations system, the international financial institutions and various bilateral aid organizations and agencies. This involves promoting an exchange of information on the requirements for international assistance; regularly reviewing the specific needs of countries in the field of population, including emergency and temporary needs; and maximizing the availability of resources and their effective utilization.

IV. INTERNATIONAL COOPERATION

71. A majority of the organizations that provided information on their activities have undertaken efforts in one or more of the three programme areas. In some cases strategic frameworks to address the population and environment issues have been adopted, in response to one of the two Conferences. Prior to the International Conference, regional population conferences were convened in all major regions. The agendas and declarations emanating from them reflect the variety of particular regional circumstances, issues and problems. They all, however, emphasize the need to adopt an integrated approach to population and sustainability issues, incorporating population concerns into environmental and sustainable development planning.

Programme area A. Developing and disseminating knowledge concerning the linkages between demographic trends and factors and sustainable development

72. Organized by ESCAP and the Conference secretariat, the Fourth Asian and Pacific Population Conference, with the central theme of "Population and sustainable development: goals and strategies into the twenty-first century", noted that understanding the interdependence between people, their development activities and the environment was of crucial importance. The Conference adopted the Bali Declaration on Population and Sustainable Development 7/ which emphasizes the crucial role of population factors in environmental balance and the paramount need fully to incorporate population concerns into strategies to achieve sustainable development.

73. A similar message was conveyed by the South Pacific Ministerial Meeting on Population and Sustainable Development. The Port Vila Declaration on Population and Sustainable Development 8/ noted the differing circumstances of the island States but none the less emphasized that all countries and territories shared a strong affinity with and dependence on land and ocean resources for their livelihood. Those resources were coming under increasing pressure due to continuing population growth, expanding economic activity and natural disasters.

74. ECLAC convened the Latin America and Caribbean Regional Conference on Population and Development. The consensus 9/ adopted by the Conference views environmental degradation as having many causes, including irrational development patterns, inappropriate technologies and consumption patterns, mainly among industrialized countries and privileged minorities in developing countries, and worsening standards of living for vast sectors of the population. The declaration points to fragile ecosystems in rural areas as particularly endangered by rapid expansion of human settlements.

75. The Declaration adopted by the Andean Meeting on Population and Development 10/ makes similar observations.

76. A conference organized by ESCWA issued the Second Amman Declaration on Population and Sustainable Development. 11/ The main issues considered by the European Population Conference, organized by ECE, were population growth, age structure and international migration.

77. As part of the preparation for the Conference, the Third African Population Conference adopted the Dakar/Ngor Declaration on Population, Family and Sustainable Development. 12/ It includes a call for African nations to accelerate the implementation of the Kilimanjaro Programme of Action for African Population and Self-reliant Development. 13/ Earlier the Economic Commission for Africa had developed a strategic framework of action with the stated objective of enabling African countries to address the problem of eradicating poverty through sound environmental management for sustainable development. Among the strategic areas identified were managing demographic change and pressures, achieving food self-sufficiency and food security and ensuring efficient and equitable use of water resources.

78. A number of publications were prepared by individual organizations prior to the Conference. The Latin American Demographic Centre (CELADE), located within ECLAC (Economic Commission for Latin America and the Caribbean), submitted a paper on population, social equity and changing production patterns to the regional conference. Further publications covering the topics of urbanization and its environmental repercussions and the environmental sustainability of the great cities of Latin America were also prepared by CELADE.

79. Extensive programmatic review and consultation were undertaken by WHO in order to examine the relationship between population dynamics and health and, in view of that relationship, the appropriate responses required from the health sector. A WHO position paper provided the starting-point for a reorientation of the health sector to the issues of population.

80. Databases providing demographic information have been updated or modified to accommodate the needs posed by the implementation of chapter 5. Throughout the United Nations system, considerable effort has been put into developing methodologies and analytical tools for better understanding the interactions of population and environment variables.

81. The Population Division of the United Nations Secretariat, with funding from UNFPA, has carried out a project aimed at investigating the current state of knowledge regarding the relationships between population and the environment in developing countries. It has prepared a draft report containing a bibliography, a literature survey of current research, and a proposed research agenda on critical aspects of those relationships. A report by the Division on governmental views of the relationship between population and the environment is being completed.

82. In 1994 UNESCO launched an interdisciplinary and inter-agency project on environment and population education and information for human development. The project seeks to refine the knowledge base and develop action frameworks to strengthen, in the various regions, education training and information activities dealing in an integrated manner with the environment and population issues; to foster the development of reoriented education, training and information programmes and materials; and to mobilize the support of decision makers and opinion leaders at the international, regional and national levels. Pilot projects to develop population and environment educational materials and technical support for the development or reshaping of national education or training programmes are being designed.

83. FAO has undertaken a number of activities, including an informal round table of experts on women, population and the environment in South-East Asia; a review of population/environment issues and concepts for population programme staff; and the organization of a conference in the Netherlands on agriculture and the environment. The conference will attempt to improve the understanding of the implications of sustainability for the agricultural sector and reach a consensus on the actions needed, including a review of population issues. With UNFPA assistance, FAO provides advisory services on population and environment, in particular for programme and project formulation and implementation.

84. ESCAP's population information programme on improved processing, management, communication and dissemination of population data and information involves the following principal activities: supplying direct technical assistance and cost-sharing in infrastructural development to national population information (POPIN) centres and networks in the region, in order to help them acquire, analyse, process and disseminate technical information and data in support of population policy formulation, planning, research and programme implementation at the national level; promoting technical cooperation among national POPIN centres and networks through the exchange of personnel, training, study visits etc.; establishing subregional population information networks and undertaking special activities with networks in other closely related fields, such as health, education, agriculture and environment; providing improved support to Governments in the acquisition, analysis, dissemination and utilization of population data and information, through the establishment of a POPIN data bank; producing and disseminating population information repackaged to meet the identified interests of various users; and increasing awareness of population issues and appreciation of their importance to national development through conferences, exhibitions, publications etc.

85. Regarding human settlements, UNCHS (Habitat) has in the years since the Conference continued to develop programmes focusing on urbanization and its impact on population dynamics - fertility trends, mortality trends, migration trends, trends in family size and environmental trends. Research is being undertaken by the Centre on these subjects and on policies and strategies related to urbanization and development issues, national urbanization, urban development policies, and strategies with special reference to relationships between human settlements and sustainable development. In a document UNCHS prepared for the Conference, on population, urbanization and quality of life, it underlined the positive effects of urbanization on social change and modernization, on fertility, mortality and other demographic trends, on personal and household income levels and on the general economic development of both the rural and urban areas.

86. Since the Conference UNFPA has undertaken and provided support for a number of initiatives aimed at exploring the relationship between population, sustainable development and the environment. These initiatives vary considerably in scope and focus. They are all, however, aimed at providing interdisciplinary perspectives and finding cross-sectoral solutions to such issues. The Fund has, inter alia, supported projects looking at such diverse topics as poverty, gender, consumption patterns and environmental refugees in the context of population, environment and sustainable development. In the field of population and sustainable development, the Fund has engaged in particularly close cooperation with ILO, FAO, the Population Division of the Secretariat and the regional economic commissions. Also, it has provided support for projects and programmes initiated by non-governmental organizations and academic and research institutions, both in the developing and the developed countries.

Programme area B. Formulating integrated national policies for environment and development, taking into account demographic trends and factors

87. Central to the integration of population concern in sustainable development policy formulation is the provision of reliable and timely information relevant to population and environment decision-making. Establishing indigenous capacity in this area is therefore of vital importance. Capacity-building exercises include ECA support for, inter alia, training at the Regional Centre for Services in Surveying, Mapping and Remote Sensing and the Regional Centre in Training in Aerospace Surveying. ECLAC supports two postgraduate courses annually for professionals in population and development. Several of the modules in the courses deal specifically with various aspects of demographics and the environment and sustainable development.

88. The regional commissions already maintain regional population databases or networks. The regional population database for Latin America and the Caribbean, DOCPAL, constitutes a bibliographical source for information, providing a number of services, including access to national databases on CD-ROM. The scope of DOCPAL is being expanded to compare population and environmental information.

89. The UNESCO/UNEP International Environmental Education Programme, in keeping with the recommendations of Agenda 21, has oriented its goals and actions world wide, incorporating population as an important component of environmental education. The aim is to contribute more effectively to improving the quality of life as well as the quality of environment. Activities include distribution of documents and materials on environmental education which also contain information on population, and disseminating the quarterly newsletter Connect.

90. UNESCO, with UNFPA support, expanded its population education programmes to more levels of the education system, including non-formal education. Activities include development of methodologies and the design and elaboration of prototype teaching/learning material.

91. UNCHS provides a range of information services. Through its City Data Programme and Human Settlements Statistical Database Programme, it is developing, collating and analysing data on population, households, gender, housing, infrastructure services and environment. The programmes aim at building and strengthening national databases on demographic and human settlements factors and trends. The work is being carried out in collaboration with the Network on Urban Research in the European Community, the International Statistical Institute, the International Union of Local Authorities and the Statistical Division of the United Nations Secretariat. It includes the collection of statistics on large cities - that is, all cities of more than 100,000 inhabitants.

92. A number of computer-aided tools are being developed to integrate population and environment information. CELADE is developing a microcomputer-based tool to help integrate population information into account geography. The project, "R+GIS Generic Population-related Application Tools", can combine population data with data for spatial display to provide alternative scenarios or illustrate the implications of various assumptions for policy makers. Four

different tools will be developed for various user groups. They should help local authorities to make knowledgeable decisions and non-governmental organizations and others outside government to make more informed proposals and suggestions for the improvements of official programmes.

93. Similarly, in 1993 the Population Division issued version 2.0 of the Database for Population and Research (PRED Bank). The focus of PRED Bank 2.0 is the interrelationship between population pressure and land use in rural areas. PRED Bank 2.0 was designed as part of the Integrated Software Package for Geographical Information, Maps and Graphics (POPMAP), an information system for microcomputers which combines database, spreadsheet and geographical mapping facilities. PRED Bank 2.0 contains national data on approximately 70 relevant variables for the period 1961-1989 for more than 100 developing countries. It is currently available in diskette form with a user's guide. A report entitled "Population pressure, land use and environment: national trends" is being completed and will be published in 1995.

94. All the organizations providing information for the present report have undertaken activities exploring, from different perspectives, the gender implications of sustainable development relevant to chapter 5. ESCWA focused on return migration in its studies of Jordanian and Yemeni returnees; it also conducted a study on family and women returnees.

95. UNFPA currently provides Governments with technical assistance in all the sectors of population policy, including institutional capacity-building, training of key personnel, support for the provision of population data and information on the linkages between population, environment, and sustainable development.

96. Facilitating the integration of environment and population concerns into development planning constitutes one of the objectives of the UNFPA Global Programme of Training in Population and Development. The focus is on developing national capacity to address the interdisciplinary nature of development. The five institutions at which training is taking place are or soon will be located in developing countries.

97. It would be helpful if the operational organizations of the United Nations system whose mandates relate to chapter 5 of Agenda 21 or chapter 3 of the Cairo Programme of Action would formulate harmonized guidelines and specific instructions for their respective field offices on implementation of the chapters. Such guidelines might be used in the country strategy notes for the coordination of project/programme activities and for joint programming.

Programme area C. Implementing integrated environment and development programmes at the local level, taking into account demographic trends and factors

98. In this programme area close cooperation between institutional partners in the United Nations system and the importance of establishing new partnerships or strengthening existing ones with governmental and non-governmental organizations, particularly grass-roots movements, in order to ensure maximum effectiveness in promoting sustainable development, were emphasized. Utilizing

the complementarity of the United Nations system and fostering cross-sectoral initiatives are considered key elements of integrated programmes.

99. ESCAP's positive experiences with local-level initiatives illustrate this point. ESCAP maintains that family-planning programmes at the local level, undertaken by community-based and non-governmental organizations, have been successful in realizing their targets. In fact such local-level agencies have emerged as a new locus of economic and social growth, providing innovative institutional arrangements through which family planning, health, education and income-generating activities can be integrated at the local level, ensuring environmentally sensitive sustainable development on a limited scale. They have the potential not only to revolutionize the delivery of reproductive health services but also to combat land degradation, promote community forestry, and in general, bring about significant improvements in living conditions for the local target populations.

100. A project using population data for local-area development planning in the countries of the ESCAP region, currently under implementation, is concerned with the analysis of the 1990 round of census data. It aims to estimate levels and trends of fertility by local area and, in the process, determine the underlying socio-economic and cultural context of success and failure in family-planning policies; analyse local-level patterns of fertility, infant/child mortality and migration vis-à-vis socio-economic characteristics and environmental variables; address the gender issue; and identify microlevel determinants of programme successes.

101. WHO is providing technical support to various countries to carry out health research (biomedical, epidemiological, social and operational) for improving the implementation of their reproductive health programmes. Particular emphasis is being given to socio-behavioural research and operations research on cost-effective integration and delivery of the elements of reproductive health care.

102. The UNCHS Community Development Programme has existed for nearly 10 years. It undertakes a wide range of activities in the seven partner countries (Bolivia, Costa Rica, Ecuador, Sri Lanka, Ghana, Uganda and Zambia) and at the global level to promote and support capacity- and institution-building in low-income urban and rural communities. The empowerment of community members and leaders to become the motivators of sustainable local development is one of the most essential means of poverty reduction in the long term. The Programme draws on Habitat's experience in participatory approaches to human development and community-based practical experience in improving human settlements. The Programme is planning to expand its activities in the developing countries so as to contribute to the improvement of the living and working conditions of low-income communities and thereby reduce their poverty.

103. The Women and Human Settlements Development Programme of UNCHS aims to ensure that all of the programmes, projects and activities of UNCHS clearly reflect gender considerations. The developmental goal is building gender awareness by introducing a process of planning, monitoring and evaluating gender components into the Centre's programmes, projects, and activities. The approach has been one of advising and training UNCHS staff, both at headquarters and in the field, to analyse projects and activities in gender-aware contexts. The

Programme is working with other key programmes of the Centre, such as the Community Participation Training Programme, the Urban Indicators Project, the Solid Waste Management Programme, and the Environmental Health and Sanitation Programme, effectively to integrate a gender perspective into programme activities in the field.

104. The Women and Human Settlements Development Programme sees the following as the key issues regarding women, environment, urbanization and human settlements development: increasing the participation of women in the design, development and implementation of policies and programmes for the sustainable development of human settlements, including increasing the proportion of women among decision makers; developing the capacity of women's organizations to participate actively in the sustainable development of human settlements; providing social facilities, environmental infrastructure and technologies that will reduce the workload of women and enhance their environmentally sound behaviour; and facilitating women's access to land and other natural resources. The Programme is currently active in major regions of Africa and Latin America. Significant progress has been made in increasing awareness of the need to integrate women into development activities in those areas.

105. UNFPA is involved in a number of new initiatives which have the potential to help bring about demographic patterns that are compatible with sustainable development. The Partners in Population and Development Initiative, launched at the Conference in Cairo, is aimed at building and strengthening technical cooperation among developing countries. The initiative was established under the leadership of Indonesia, and its major objectives are to promote the idea of South/South collaboration, share experiences, and undertake fund-raising. The member countries have successfully pursued population policies and have, or are undergoing, a demographic transition to more sustainable population growth.

106. According to a recent report of the Executive Director of UNFPA,

> The scope of activities in the area of population and sustainable development policy should be broadened and linked with efforts in the areas of health, education, family planning, the condition of women, poverty alleviation and the environment - the aim being to make population policy truly an integral part of all other efforts towards sustainable development. This will require support for data collection and analysis, relevant socio-cultural and operations research, the creation and maintenance of relevant databases and support for policy formulation. 14/

107. The many projects and programmes referred to above do not provide an exhaustive account of the activities of the organizations of the United Nations system and other international organizations. The World Bank's substantial lending to population programmes, for example, is not included.

108. The picture that emerges, however, gives ample reason to believe that in the field of population, environment and sustainable development there is considerable need - and many opportunities - for coordination and collaboration.

V. CONCLUSIONS AND PROPOSALS FOR ACTION

A. Conclusions

109. The general awareness of the importance of demographic trends and factors to environmental and developmental sustainability has increased gradually over the past few decades. The adoption of Agenda 21 did more than any other event to bring the issues to the fore. Since then, the number of people who came to recognize the significance of the issues further increased and reached its peak as a result of the Cairo Conference in September 1994. The Programme of Action of that Conference is, on the one hand, a measure of where the world stands on major demographic issues and, on the other, a measure of how much remains to be done in the field of population, environment and sustainable development.

B. Proposals for action

110. The Commission on Sustainable Development might wish to:

(a) Urge Governments to implement the goals and recommendations of the Programme of Action of the International Conference on Population and Development, with special reference to chapter III, in view of the Conference's mandate in this area;

(b) Recommend to Governments that they allocate to appropriate institutions, both public and private, national and international, sufficient resources for further examining the relationship between population, environment and sustainable development in order to improve the quality of planning and policy formulation;

(c) Recommend to Governments that they reinforce their efforts at institution-building in the field of population and population policies with a view to prompt integration of population concerns into environmental and sustainable development planning and policies;

(d) Recommend to the respective bureaux of the Commission on Sustainable Development and the Commission on Population and Development that they explore the feasibility of holding joint meetings with a view to examining issues with a bearing on the implementation of chapter 5 of Agenda 21 and chapter III of the Programme of Action;

(e) Encourage major groups working in the population/gender field and in other sustainable development fields to increase their communication, cooperation and coordination at the local, regional and international levels in order to reinforce their contribution to the mutual understanding of these issues and to facilitate their active participation in the implementation of chapter 5 of Agenda 21 and chapter III of the Programme of Action;

(f) Recommend that UNFPA, with the assistance of UNEP, UNDP and other relevant institutions, explore the possibility of submitting to the Commission a periodic report on populations at risk owing to the cumulative effects of local environmental degradation;

(g) Recommend that Governments, organizations of the United Nations system and major groups should give particular attention to the need to involve women in decision-making at all levels in sustainable development strategies, policies, projects and programmes;

(h) Suggest that in the guidelines for voluntary national reports to the Commission, appropriate consideration be given to population and gender concerns.

Notes

1/ Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992, vol. I, Resolutions Adopted by the Conference (United Nations publication, Sales No. E.93.I.8 and corrigenda), resolution 1, annex II.

2/ New York, Oxford University Press, 1987.

3/ See A/C.2/44/6, annex.

4/ The Challenge to the South: The Report of the South Commission (New York, Oxford University Press, 1990).

5/ See A/CONF.171/13 and Add.1.

6/ Ibid., chap. I, para. 1.5.

7/ See E/CONF.84/PC/14.

8/ See A/C.2/48/3.

9/ See E/CONF.84/PC/17.

10/ See A/CONF.171/PC/7/Add.1, paras. 42-45.

11/ See E/CONF.84/PC/16.

12/ See E/CONF.84/PC/13, annex II.

13/ See E/CONF.76/6, pp. 33-45.

14/ DP/1995/8, para. 15.

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EDUCATION, SCIENCE, TRANSFER OF ENVIRONMENTALLY SOUND TECHNOLOGIES, COOPERATION AND CAPACITY-BUILDING

Science for sustainable development

Report of the Secretary-General

SUMMARY

The present report covers issues related to science for sustainable development, as discussed in chapter 35 of Agenda 21. The report focuses on the experiences of national Governments, the United Nations system, other international organizations and the scientific community in implementing science-related policies and programmes at the national, regional and international levels (paras. ___). Based on this analysis, priority issues have been identified within the four programme areas for which specific actions need to be taken (paras. ___). Several policy recommendations to encourage and promote those actions are presented (para. ___).

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INTRODUCTION

1. The multi-year thematic programme of work adopted by the Commission on Sustainable Development at its first session identified chapter 35 of Agenda 21, 1/ "Science for sustainable development", for review by the Commission at its third session, in 1995. The present report provides a basis for the forthcoming discussion of the Commission on how to encourage and support national initiatives and strengthen international cooperation with a view to enhancing the contribution of science to sustainable development, particularly in developing countries.

2. The analysis of the report covers the four programme areas of chapter 35, namely:

(a) Strengthening the scientific basis for sustainable management;

(b) Enhancing scientific understanding;

(c) Improving long-term scientific assessment;

(d) Building up scientific capacity and capability.

3. The report focuses on the experiences of national Governments, the United Nations system, other international organizations and the scientific community in implementing science-related policies and programmes at the national, regional and international levels. Based on this analysis, priority issues have been identified within the four programme areas for which specific actions need to be taken by national Governments, with the support of international organizations and major groups, in particular the scientific community. Several policy recommendations to encourage and promote those actions are presented for consideration by the Commission.

4. Linkages have been established to the extent possible with other cross-sectoral chapters of Agenda 21, in particular chapters 31, "Scientific and technological community", 34, "Transfer of environmentally sound technology, cooperation and capacity-building", 36, "Promoting education, public awareness and training", and 37, "National mechanisms and international cooperation for capacity-building in developing countries".

5. The report benefited from the consultative process during the inter-sessional period, which involved the United Nations system, governmental and non-governmental organizations and the scientific community, in particular the International Council for Scientific Unions (ICSU). An inter-agency consultation was convened by the United Nations Educational, Scientific and Cultural Organization (UNESCO) (Paris, 24 and 25 March 1994), with the participation of United Nations bodies and organizations, including the Food and Agriculture Organization of the United Nations (FAO), the World Meteorological Organization (WMO), the United Nations Industrial Development Organization (UNIDO), the United Nations Environment Programme (UNEP), the United Nations Centre for Human Settlements (Habitat), the Department for Policy Coordination and Sustainable Development of the United Nations Secretariat, the United

Nations University (UNU), the Economic and Social Council for Western Asia (ESCWA) and the Economic Commission for Africa (ECA), other international organizations, such as the Organisation for Economic Cooperation and Development (OECD), and scientific institutions, in particular ICSU. The inter-agency consultation agreed on the outline for the report and its major contents.

6. Extensive use was made of information provided to the Commission by national Governments, the United Nations system, governmental and non-governmental organizations, and research and development institutions. Contributions from individual experts were also taken into account. Reference is made to recent relevant publications by, for example, UNESCO, UNIDO, FAO, WMO, the United Nations Development Programme (UNDP), the United Nations Conference on Trade and Development (UNCTAD), the World Bank, OECD, ICSU and the Third World Academy of Sciences (TWAS).

I. ASSESSMENT OF THE CURRENT SITUATION AND TRENDS RELATED TO SCIENCE FOR SUSTAINABLE DEVELOPMENT

A. The role of science in achieving sustainable development

7. The policies and programmes being developed and implemented by national Governments, the United Nations system and other intergovernmental organizations have emphasized the key role of national scientific capacities and capabilities for achieving sustainable development objectives. It is not an exaggeration to assert that without science there can be no sustainable development. A critical mass of scientists and engineers is needed in developing and developed countries alike for the development, adaptation and use of environmentally sound technologies and production systems. Science is the basis for sustainable agricultural and industrial development, as well as for meeting the world's increasing energy demand.

8. Effective actions to ensure a sustainable future for human society on Earth need to be based on the assessment of the impact of human activities on natural systems and the well-being of people. To understand the impact of human activity on the environment and, subsequently, to identify appropriate solutions, a solid knowledge is required of the functioning of ecosystems and their interrelations with human society. Thus, policy-making for sustainable development centres around extremely complex questions for which interdisciplinary scientific information from both the natural and social sciences is needed to find viable and long-term solutions.

9. Scientific research conducted during the last 30 to 40 years has led to the understanding that there are limits to the healthy functioning of life-support systems. That understanding has been instrumental in moving towards the concept of sustainable development. A major challenge for science, on the eve of the twenty-first century, is to deepen this understanding of the functioning of the overall Earth system through further investigation of boundaries or limits within which development can take place. It will also be necessary to determine the rates at which those limits will be reached. Both questions require intensive research in order to improve the forecasting capabilities needed to

design sustainable development strategies. Buying time to do that research is one of the most important rationales for applying the precautionary principle.

10. At present, many developing countries, in particular the least developed ones, lack even a critical mass of qualified scientists in the relevant disciplines. Without an endogenous scientific capacity and infrastructure, development is impeded. These countries are not in a position to carry out the scientific work needed and to apply the science needed for addressing their environment and development problems. These countries are also unable to participate actively in international Earth system research programmes and in international conventions dealing with the global environment. Only a strong science education programme can ensure such a critical mass of scientists, beginning in primary school and continuing through secondary school to graduate and post-graduate research and training.

11. Recent publications by UNESCO, UNDP, the World Bank and UNCTAD conclude that there are three crucial factors associated with economic development: science, technology and education. Their studies show that there is a relation between investments in science and education and the growth of gross national product (GNP) in countries showing rapid economic growth. The correlation between science and the growth of GNP highlights the important role of science in furthering the societal goals of economic growth and environmentally sound and sustainable development.

12. The information available from countries, including those submitted by national Governments to the Commission, indicate that very few countries have taken specific measures in direct response to chapter 35 of Agenda 21. In a number of countries, however, scientists have been included either in their personal capacities or as ex officio representatives of national scientific institutions in the national coordination mechanism (national commission/ national council for sustainable development).

13. Developing countries generally consider both internal and external brain drain to be a most serious problem in relation to science for sustainable development. While provisions ensuring the equal treatment of women in national science policy and scientific institutions already exist in a large number of countries, it appears that there have been no specific measures taken in this respect in direct response to chapter 35 of Agenda 21.

B. Intergovernmental processes

14. Two intergovernmental processes have been launched recently that are specifically dedicated to supporting science for sustainable development in developing countries and to sensitizing governmental decision makers at the highest possible level to this need.

15. The first process was initiated by the Prime Minister of Pakistan, who invited heads of State and their representatives to endorse the establishment of a Commission on Science and Technology for the South (COMSATS). Forty-nine countries were represented at the first meeting of COMSATS (Islamabad, 4 and 5 October 1994), which was chaired by the Prime Minister of Pakistan. The

objective of COMSATS is to provide political and economic support for major initiatives related to scientific capacity-building. In this vein, COMSATS endorsed the aim of creating 20 centres of excellence in the South as the frontier areas of science related to sustainable development, and established the Network of International Centres of Excellence in the South, with headquarters in Islamabad. COMSATS called for enhanced North-South and South-South cooperation in order to achieve self-reliance and adequate endogenous scientific capacity in the South. The COMSATS Technical Assistance Fund was established, with Pakistan contributing Rs 30 million (equivalent to US$ 1 million).

16. The second process, the Presidential Forum on the Management of Science and Technology for Development in Africa, was initiated by a regional non-governmental scientific organization called the Rand Forum. The Presidential Forum met for the first time in Maputo, in 1993. The second Presidential Forum was held in July 1994 and was attended by 16 heads of State or their representatives, who endorsed the establishment of an African Foundation for Research and Development. The meeting reaffirmed its support for the periodic sessions of the Presidential Forum as a major endeavour to sensitize the African geopolitical and geo-economic leadership to the crucial role of science-led development.

17. Specific scientific issues and activities were addressed in the context of the conventions on biological diversity, 2/ climate change 3/ and desertification 4/ aimed at promoting technical and scientific cooperation; research and development; scientific and technological capacity-building; and the establishment of intergovernmental scientific and technological advisory bodies.

18. The Global Conference on the Sustainable Development of Small Island Developing States (Barbados, 26 April-5 May 1994) recognized the important role of science and technology by including in its Programme of Action, 5/ a separate chapter (chap. XIII) on this issue. Moreover, within the topical chapters on such subject areas as climate change, sealevel rise, natural and environmental disasters, and management of wastes, the need for a strong scientific basis was emphasized.

C. United Nations system and major international scientific organizations

1. Main activities in relation to the four programme areas of chapter 35 of Agenda 21

(a) Strengthening the scientific basis for sustainable management

19. By including this programme area in chapter 35 of Agenda 21, the United Nations Conference on Environment and Development (UNCED) recognized that development and natural resources management will be sustainable only if it is based on sound science, using the best scientific knowledge available and with continued research to improve the knowledge base. In this respect, with the support of international organizations, as appropriate, countries need to:

(a) Collect, analyse, interpret and disseminate scientific data and information related to the broad areas of sustainable development as defined in Agenda 21, and develop and apply science-based policies, resource management systems and technologies;

(b) Generate through science new knowledge that is relevant for sustainable management and policy-making, in particular through interdisciplinary research.

20. While these are tasks for industrialized and developing countries alike, the gap between them is widening. Many developing countries, particularly in Africa, lack the necessary scientific manpower and infrastructure. The bodies and organizations of the United Nations system, including the World Bank, have a long tradition of supporting programmes and activities in developing countries aimed at strengthening the scientific basis either in particular sectors, such as food, agriculture, fisheries and forestry (FAO), industry (UNIDO), health and sanitation (WHO), agrometeorology and operational hydrology, weather and climate forecasting and services (WMO), or for broader scientific inquiry in the basic engineering, social and environmental sciences (UNESCO, UNU). The regional commissions have also developed programmes focused on strengthening science as related to development in the developing countries. ICSU has mounted a programme dedicated to strengthening scientific capacities in developing countries related to global change research.

(b) Enhancing scientific understanding

21. This programme area of chapter 35 stresses the need to:

(a) Carry out research programmes in order to better understand the carrying capacity of the Earth as conditioned by its natural systems, such as the bio-geo-chemical cycles, the atmosphere/hydrosphere/lithosphere/cryosphere system, the biosphere and biodiversity, the agro-ecosystem and other terrestrial and aquatic ecosystems;

(b) Develop and apply new analytical and predictive tools in order to assess more accurately the ways in which the Earth's natural systems are being increasingly influenced by deliberate and inadvertent human actions, demographic trends, and the impact and consequences of those actions and trends;

(c) Integrate the physical, economic and social sciences in order to better understand the impacts of economic and social behaviour on the environment and of environmental degradation on local and global economies.

22. The international research programmes needed to understand the Earth system, its carrying capacity and the mechanisms governing its life-support systems, are now by and large in place. These programmes, which involve United Nations bodies and organizations as well as other international organizations, include the International Geosphere-Biosphere Programme (IGBP) of ICSU; the joint WMO/UNESCO/ICSU World Climate Research Programme (WCRP); Diversitas, a joint programme on biodiversity of the International Union of Biological Sciences (IUBS), the Scientific Committee on Problems of the Environment (SCOPE) of ICSU and UNESCO; the Global Atmosphere Watch (GAW) of WMO; the International

Hydrological Programme (IHP) of UNESCO; and some others. The agro-ecosystems and the terrestrial and aquatic ecosystems are the subject areas of scientific activities of FAO and UNEP, as well as the major focus of UNESCO's Man and the Biosphere (MAB) Programme. The lithosphere is the subject of the International Geological Correlation Programme (IGCP) jointly sponsored by the International Union of Geological Sciences and UNESCO.

23. The relevant organizations, based on decisions of their governing bodies, have also started to develop comprehensive global observation systems for the major components of the Earth system, such as the Global Climate Observing System (GCOS) sponsored by WMO, UNEP, the Intergovernmental Oceanographic Commission (IOC) and ICSU; the Global Ocean Observing System (GOOS) sponsored by IOC, WMO and ICSU; and the Global Terrestrial Observing System (GTOS) sponsored by UNEP, UNESCO, FAO, WMO and ICSU.

24. Progress has been made in the integration of natural sciences and socio-economic research at the national, regional and international levels. That progress, however, appears to be proceeding more slowly than anticipated. The Human Dimensions of Global Change Programme (HDP) has been launched by the International Social Sciences Council (ISSC). Another encouraging example is that UNESCO's Man and the Biosphere (MAB) Programme has been reoriented since UNCED to further enhance its interdisciplinary function and to include a major focus on the links between economics and natural resources research.

25. A distinction needs to be made between international scientific undertakings dedicated to Earth system research on global environmental issues, such as climate and biodiversity, and the need to integrate environmental science in other major fields of science, such as agriculture and health. Significant progress has been made during the last few years in this respect. An example is the integration of a sustainable agriculture component into agricultural research as well as into the work of the international research centres of the Consultative Group on International Agricultural Research (CGIAR), which are co-sponsored by the World Bank, FAO and UNDP.

(c) Improving long-term scientific assessment

26. The primary objective of this programme area is to provide assessments of the current status and trends in major developmental and environmental issues at the national, subregional, regional and global levels. These assessments need to be based on the best available scientific knowledge in order to develop strategies for achieving sustainable development.

27. At the international level, the main scientific assessment programme under way is that of the Intergovernmental Panel on Climate Change (IPCC) sponsored by WMO and UNEP. IPCC has proven to be a valuable tool for Governments. Based on its scientific assessments, IPCC has proposed various response strategies to counter the potential impacts of climate change. As the IPCC interfaces efficiently with the international scientific community, its framework could serve as a model for similar assessment panels on environment and development. Other important scientific assessments being coordinated by the scientific community include assessments for stratospheric O3 (WMO and UNEP), for greenhouse gases (WMO/GAW), and for marine pollution (Joint Group of Experts on

the Scientific Aspects of Marine Pollution (GESAMP)). The UNCTAD Advanced Technology Assessment System addresses technology-related issues of sustainable development.

28. Over the past few years, a large number of statistical publications and reports on the status of environment and development have been launched and continue to gain prominence. In this regard, important contributions are being made, for example, by UNDP, UNESCO and UNEP, as well as by non-governmental organizations, such as the World Resources Institute and the World Conservation Union. Several agencies are developing indicators for sustainable development, including on the basis of cooperation.

(d) Building up scientific capacity and capability

29. The primary objective of this programme area of chapter 35 is to improve the scientific capacities of all countries, in particular the least developed countries, in order to enable them to fully participate in the generation and application of scientific research concerning sustainable development. Traditionally, scientific and technological capacity-building in developing countries has been an area accorded high priority by United Nations bodies and organizations. Accordingly, efforts have been reinforced and capacity-building programmes reviewed to better address the new paradigm of linking environment and development.

2. Enhancement of inter-agency cooperation

30. Inter-agency cooperation and coordination in the field of science has been enhanced since UNCED through the efforts of the ACC Inter-agency Committee on Sustainable Development (IACSD) and its two subcommittees on oceans and coastal areas and on freshwater resources. The establishment by IACSD of the task-manager system was of crucial importance in this respect.

31. The United Nations bodies working with UNESCO as task manager for chapter 35 have agreed to set in motion a process of enhanced cooperation and coordination focused on the implementation of this chapter. The group has agreed that the first step towards this goal is more efficient exchange of information, followed by increased quantity and quality of joint activities, and the development of joint programming where appropriate. The ultimate objective is to eliminate overlap, to pool expertise and resources and to concentrate international action on the priority areas of common concern.

32. At its 1994 substantive session, the Economic and Social Council addressed the division of labour and improvement of coordination within the United Nations system in the field of science and technology. It was concluded that as an immediate focus for coordination and joint action in science and technology at the inter-agency level, organs and organizations of the United Nations system should give particular attention to (a) science and technology policy and planning capabilities at the national level; (b) the sustainable use of natural resources; (c) new technologies, including biotechnology; and (d) education and human resources development.

33. Several major initiatives have already been taken since UNCED to enhance cooperation between relevant United Nations agencies. A number of these initiatives also involve major international scientific organizations, as well as major national organizations that are geared towards international cooperation in scientific fields related to sustainable development.

34. UNEP, in partnership with UNESCO, ILO, UNIDO and a number of universities, has developed a series of training programmes for cadres of ministries of environment of developing countries in the field of environmental management, which involve both the scientific and ecological foundations of environmental care and modern management tools, such as simulation models and resources accounting. The ultimate objective of the United Nations system is for developing countries to develop and run national and regional training courses in direct response to their needs.

35. A novel collaborative venture, Project 2000+: Science and Technology Education for All, has been launched by UNESCO to address the priority area of scientific capacity-building and science education, with an emphasis on developing countries. The objective of Project 2000+ is to ensure scientific and technology literacy for all children, youth and adults throughout the world. Project 2000+ is based on partnerships between a group of major intergovernmental organizations and agencies and non-governmental organizations that have special concerns and responsibilities in the field of science and technology education and research. Its Steering Committee includes UNESCO, UNICEF, UNDP, UNEP, the World Bank, the Commonwealth secretariat, ICSU, and several international non-governmental bodies grouping associations for science and technology education.

36. The World Climate Programme (WCP), for which WMO plays an overall coordinating role, is another example of enhanced inter-agency cooperation and, to some extent, integration of activities by a number of United Nations bodies and ICSU. In 1993, a special intergovernmental meeting on the theme "Climate agenda" was held to determine the WCP response to UNCED. At this meeting, the sponsors of WCP (WMO, UNEP, UNESCO/IOC, FAO and ICSU) were asked by the Governments represented to draw up an integrated proposal to Governments indicating programme and budget requirements for the next several years according to the four main thrusts of the WCP: climate services for sustainable development, studies of climate impact assessment and response strategies to reduce vulnerability, new frontiers in climate science and prediction, and dedicated observation of the climate system. The socio-economic benefits of climate research for member States will also be addressed. An integrated proposal will be presented to the governing bodies of the sponsoring institutions in 1995.

37. The World Bank has indicated its willingness to support another international initiative promoted by developing countries in specialized fields and in centres of excellence. This initiative is designed to establish strategic links among the agricultural, environmental, basic and engineering sciences. The project will identify 20 centres of excellence in various regions of the South that will promote capacity-building in science and technology according to the priorities of each region and with the commitment of Governments in the region. Each regional or international centre is expected to

encompass a network of national centres aimed at training scientists and promoting research and development. The regional centres will form a global network. The backbone of the international network will be the international agricultural research centres of CGIAR (co-sponsored by the World Bank, FAO and UNDP). Other intergovernmental organizations with major science programmes, such as UNESCO, UNIDO and WMO, would also be invited to participate, as well as major scientific non-governmental organizations, such as TWAS.

38. Another example of recent efforts to enhance international cooperation related to science and Agenda 21 is the newly launched pilot project entitled Global Forum for Sustainable Development Research and Capacity Development (Bellanet). Bellanet (named after Bellagio in Italy) aims to promote and achieve efficient information exchange, more concerted efforts and concrete collaboration among a broad range of donors and actors, including intergovernmental organizations, bilateral donors and foundations in the field of research and development for sustainable development in developing countries. This initiative has been developed by IDRC (Canada), the MacArthur Foundation, the Rockefeller Foundation, SAREC (Sweden), and the World Bank, on the basis of consultations with other United Nations agencies and bilateral donors. The project includes specific provisions to ensure relevance and linkages of Bellanet with Governments and the scientific communities in the developing countries.

D. Financing of science for sustainable development

39. Consistent with the relevant decision of the Commission on Sustainable Development taken at its second session, the in-depth discussion on the financial aspects of science for sustainable development was part of the overall discussion on financing the implementation of Agenda 21 that took place in the context of the Inter-sessional Ad Hoc Open-ended Working Group on Finance (New York, 6-8 March 1994). In the context of the present report, the financing of science for sustainable development is considered as it is directly related to the priority issues discussed in the report. The financial implications of research and development in relation to the sectoral issues to be discussed by the Commission at its third session are not addressed.

40. There are considerable financial implications associated with the measures to be taken to implement chapter 35 of Agenda 21. The financial responsibility of Governments with regard to science is significant. Developing country Governments need to consider long-term investment in science education a high priority, on the premise that such investment will unlock a vast human capital that has been underexploited to date: the intellect of present and future generations. At the same time, developing country Governments need to increase the financial resources devoted to science and technology, particularly with regard to research and development.

41. Financing for science for sustainable development is being provided primarily at the national level through national and provincial governments, industry and business, as well as by foundations and sometimes by non-governmental organizations. In most countries, the data available does not distinguish between the financing of research and development in general and the

financing of science for sustainable development in particular. As stated in UNESCO's World Science Report, published in 1994, many industrialized countries spend about 3 per cent of their GNP on research and development activities. In developing countries, the figure in most cases is significantly below 1 per cent. This demonstrates that there is a great shortfall of funds needed for increased scientific capacity-building in developing countries, in particular in the least developed countries.

42. Financial support to developing countries in the field of science is provided by a number of bilateral donors. The limited availability of funds for research assistance and training in specialized scientific fields, however, has become a particular concern. With the shrinking overall volume of development assistance funds and with acute emergencies in developing countries on the increase (e.g., in Somalia and Rwanda), it is becoming more and more difficult to defend aid budgets for long-term capacity-building for research. There is a need to reach agreement among donors of research assistance on the measures that must be taken to safeguard resources for essential purposes; to agree on common programmes; and to seek synergy and increased efficiency.

43. Relevant bodies and organizations of the United Nations system, including the World Bank and intergovernmental regional banks, continue to be another major source of financial support for scientific activities and scientific capacity-building in developing countries. In addition to the financial means provided for this purpose, a number of United Nations bodies and organizations, including FAO, UNESCO, UNIDO and UNEP, have spent a considerable share of their regular programme funds on supporting programmes and activities related to science for sustainable development and scientific capacity-building in developing countries.

44. Given the serious lack of resources and qualified personnel in the least developed countries, a realistic short to medium-term strategy for building scientific and technological capacity to manage the transition to sustainable development would be to concentrate on subregional measures rather than national ones. Subregions usually tend to share several common characteristics that facilitate a more rational and efficient use of resources, including qualified staff. Subregional efforts also have greater potential for creating local capacity in the short to medium term than regional (continental) and international programmes. Examples of subregions are East Africa, southern Africa, West Africa, and the Caribbean. Frequent contacts between scientists from developing and industrialized countries is a precondition for rapidly disseminating and applying new scientific and technological methods. At relatively low cost, much can be achieved in practical terms by providing funds for scientific visits and meetings, electronic communication, access to data banks etc.

45. Two recent important initiatives have been taken to enhance the funding of science and technology for sustainable development in developing countries, in particular in Africa. The first initiative is the above-mentioned creation of the COMSATS Technical Assistance Fund; the second is the creation by UNESCO of the International Fund For Technological Development of Africa. UNESCO has already contributed US$1 million as seed money to the Fund, as a mark of its commitment to the technological development of the African region. The Fund is

aimed at supporting science and technology for sustainable development in Africa, in particular at promoting intensive interaction between national scientific and engineering institutions and local industry.

46. The financing of international scientific programmes, in particular those of an intergovernmental nature, such as the World Climate Research Programme (WMO, IOC of UNESCO and ICSU) or the International Hydrological Programme of UNESCO, is again primarily provided by national Governments. Governments naturally give priority to financing the national activities feeding into these internationally mandated and coordinated programmes. Hence, it is generally more difficult to raise the funds needed for the international coordination efforts within each programme and for true international cooperative activities, in particular those supporting developing country participation in these activities. Governments should realize that internationally coordinated scientific programmes need to have sufficient international core funding in order to work efficiently as true programmes.

47. In conclusion, a major obstacle to initiating essential activities for implementing the objectives of chapter 35 of Agenda 21, in particular in developing countries, is the lack of funds allocated to science and science education. The Commission may wish to address appropriate measures to increasing financing for priority actions at the national level related to science for sustainable development, in particular scientific capacity-building in developing countries, and to formulate recommendations addressed to multilateral and bilateral donor agencies and Governments, as well as specific funding mechanisms, such as the Global Environment Facility (GEF).

II. STRATEGIC ISSUES CONCERNING SCIENCE FOR SUSTAINABLE DEVELOPMENT

48. The overview of the four programme areas of chapter 35 of Agenda 21 that has been provided above, as well as the subsequent review of the status of implementation of the objectives of that chapter, demonstrates the need for broad action at the national, subregional, regional and global levels. Strategic issues for which there is a need for priority actions are:

(a) Capacity-building in science, with particular relevance to the needs of developing countries;

(b) Strengthening international scientific cooperation;

(c) Improving communication of science;

(d) Enhancing the application of science.

A. Capacity-building in science, with particular relevance to the needs of developing countries

49. An integral part of development and environment planning in developing countries should be provision for capacity-building, in particular in the least developed countries. Radical measures should be taken by Governments in developing countries, particularly in Africa, in the following areas: general science education and training; enhancement of the status of science; science in national development plans; and training in specialized fields and interdisciplinary approaches. While these questions are of greatest relevance for the developing countries, they are also of strategic importance for the developed countries and the economies in transition.

50. Developing countries are approaching the end of the twentieth century with a monumental challenge to their survival and long-term development. Perhaps the greatest challenge facing humankind is how to provide adequate amounts of food, water, raw materials and energy for a projected world population of between 8 and 10 billion by the year 2020, which will call for an enormous response. For example, most people agree that world food supplies will have to more than double over the next 30 years. To achieve the requisite increases in the productivity of resource use in a sustainable way calls for new integrated systems of knowledge. Today, biotechnology and information technology are providing some of the solutions, as well as pointers to the future. But more creative work on new integrated systems is required. Above all, greatly increased investment in science and technology will be necessary.

51. The ability of developing countries to meet this challenge will depend on their ability to participate in and benefit from the scientific and technological revolution that is rapidly unfolding in the developed countries. The new forces of modern science and technology, if harnessed properly and applied in accordance with each country's particular socio-economic and cultural circumstances, offer immense possibilities for solving many of the complicated problems that are currently impeding economic, social and environmentally sound and sustainable development in the developing countries. For example, recent advances in tissue cultures, genetic engineering, biotechnology and biometeorology could be instrumental in increasing agricultural productivity, reversing land degradation and conserving biodiversity in the ecologically fragile zones of the South. The challenge is, therefore, for developing countries to master modern science and technology as part of the movement towards sustainable development. This should be achieved by first building up their indigenous capacity and then transferring the technology and know-how needed to maximize productivity.

1. General science education and training

52. Building indigenous capacities calls for the strengthening of science education at all levels. The fundamental importance of literacy for all is now recognized by developing countries. A similar emphasis and commitment needs now to be given to science education, which is the starting point for building a sound technology base. Science education should begin at the primary school level, when attitudes and behaviour are shaped. This needs to be understood as

a strategic issue requiring action during the next decade, particularly in terms of funding for scientific equipment in schools and universities, and for restructuring secondary and higher education systems, especially in the fields of mathematics and other basic sciences and technical training.

53. The four basic sciences - biology, chemistry, mathematics and physics - are indispensable for understanding, applying and developing all branches of science and technology within the context of sustainable development. Higher education and research in the basic sciences need to be strengthened, in particular in the least developed countries, with special emphasis on the infrastructure required, i.e., laboratories (including equipment, instrumentation, electricity and water supplies, and consumables), libraries and other basic facilities.

54. Among the basic sciences, biology and chemistry attract more students and practitioners than physics and mathematics. For instance, in sub-Saharan Africa, the output of postgraduate physicists and mathematicians is very low, as a result of which even the essential replacement of retiring university teachers is in jeopardy. Therefore, special attention should be paid to promotion of postgraduate and research training in physics and mathematics in the least developed countries.

2. Enhancement of the status of science

55. The classical brain drain of scientists can be avoided only if the status of scientists, scientific institutions and the government bodies responsible for science and technology improves. In many countries, particularly in the developing world, scientists, scientific institutions and government agencies responsible for science have a low priority in society in general and on governmental agendas in particular. To change this situation, the following steps should be taken:

(a) Provide adequate salaries and other incentives for scientists;

(b) Provide adequate financing for scientific institutions, including universities, especially with respect to scientific instruments and equipment;

(c) Set up or strengthen professional scientific associations and other means of reinforcing the scientific and technological community in order to improve quality through peer review and raise the self-confidence of scientists;

(d) Provide leadership at the highest level - when appropriate by the head of State - to national bodies charged with formulating and implementing science and technology policy;

(e) Promote public understanding of the role of science for sustainable development;

(f) Give emphasis to fully utilizing the talents of women and to their career development.

3. Science in national development plans

56. Strategies, policies and plans should exist at the national level, and, as appropriate at the subregional and regional levels in order to ensure the development of scientific capacity and the management of science. Recognizing that science and technology are essential for both economic (including industrial and agricultural) development and for the protection of the environment, increasing numbers of Governments now integrate science and technology into their national development plans. It is recommended that Governments follow that approach whenever feasible.

57. Most smaller countries do not possess economies of sufficient scale to allow for a national scientific infrastructure of the scope required to address national needs. One solution to this problem is for countries to cooperate at the subregional or regional levels to share institutions of higher learning and advanced research and development. Pooling the resources of countries with similar problems is more cost-effective than trying to develop national institutions.

58. National science plans should also promote strong linkage between universities and research institutions, on the one hand, and national industries and agriculture etc. on the other, so that scientific knowledge and information finds its way into the productive sectors. Measures should be taken to make the private sector of national economies invest more in the development of science.

59. Women and men from all regions of a country and belonging to all its various ethnic groups need to be mobilized to participate in national science and technology efforts. Because some of a country's most valuable natural resources may be found in remote areas, often known only to groups on the fringes of society, the inclusion of such groups is essential. Governments need to be sensitized to the importance of involving such groups, which might sometimes require administrative restructuring. Non-traditional partners for scientific activity, such as the military, can also be engaged in national and regional efforts for sustainable development.

60. The brain drain of specialists from developing countries to industrialized countries is a well-known problem that requires urgent action. Existing research and training institutions, particularly those in critical areas such as food security, soil erosion, deforestation and desertification, energy supply and tropical diseases, need to be upgraded in order to provide the necessary conditions for scientists to carry out research. In each subregion, there should be at least one centre of excellence in each of these critical fields.

61. Another measure to alleviate the brain drain is for Governments in the South and international and bilateral donor organizations to establish in developing countries research and training centres in key areas of frontier science and high technology, such as molecular biology, biotechnology, informatics and new materials. If a number of well established and competent institutions can reach the standards of international excellence, it will be possible to retain scientists in their countries of origin.

4. Promoting interdisciplinary approaches and use of new technologies

62. The science addressed in chapter 35 is intended to provide the knowledge base for sustainable development and must therefore be designed to cover all facets of the complex problems of environment and development as they appear at the global, regional, and local levels. Traditional disciplinary research is inadequate, because in that approach only part of a problem is treated in isolation from other interrelated parameters. Disciplinary scientific work needs to be complemented by interdisciplinary research involving the basic and engineering sciences, environmental sciences, economics, demography, and other social and human sciences.

63. The role and impact of human activity within the natural environment needs to be the focus of research relevant to sustainable development. In the past, humans were seen as separate from the natural environment. What is needed is to recognize that humans are an integral part of ecosystems and to understand the interrelationships that affect humans and the natural resource base.

64. Research intended to study those interrelationships needs to be problem-oriented, i.e., to focus on specific problems of resource use and management as they appear in real life. Scientists from different disciplines need to design research programmes together with planners, managers and local populations to plan, execute and follow up research work. This kind of scientific endeavour requires new organizational structures of research and science at the national level. Such science needs to include prospective studies in order to improve the ability of the sciences to predict the likely consequences of human activity and the changes over time that can be expected in the Earth's natural and human systems.

65. The use of new information and communications technologies has far-reaching implications for science related to sustainable development. It is now possible to better manage massive amounts of data, such as satellite data, in order to track global conditions and trends. Technologies such as GIS and sophisticated computer modelling are important tools for carrying out research on the whole Earth system in order to understand the interactions among the atmosphere, the biosphere, and the geosphere at a global level. New technologies also allow for rapid, frequent and low-cost interaction among scientists around the world. Scientific research and capacity-building related to sustainable development need to take further advantage of the new opportunities offered by such technologies.

5. Training in specialized fields

66. Despite considerable efforts, many developing countries, in particular the least developed countries, do not yet possess a critical mass of trained personnel in specialized fields and in interdisciplinary approaches related to sustainable development. Efforts must be increased to train specialists in many specific areas of science, including those in the topical chapters of Agenda 21 (chaps. 9 to 22). Many countries do not have adequate training facilities at universities or other institutions to prepare scientists to carry out research

related to development and policy-making. Specific attention needs to be given to the development of such facilities.

67. The recycling of materials and energy is the foundation on which sustainable development rests. The relatively new science and technology of recycling in the modern sector is virtually non-existent in most developing countries. Policies, strategies and resources are needed urgently to put this new science in place in education, application and research within the specific contexts (geographical, ecological, climatic, resources, population, education levels, etc.) of the developing world.

68. An understanding of specific scientific and engineering disciplines is crucial in the era of recycling. Such disciplines include thermodynamics, the self-organization and reorganization of biological systems, the management of cities as closed-loop systems and waste management techniques. The social sciences also have an important role to play in this context and there is a large body of research findings on low-cost participatory approaches to environmental management in third world cities and rural areas.

69. A problem shared by developing and industrialized countries alike is that most current training programmes and institutional structures are sectoral and disciplinary and do not address the complex interactions among people, natural resources, technology, environment and development. This constitutes a major challenge in the training of a new generation of scientists, engineers and other experts, who need to have appropriate interdisciplinary insights and knowledge if they are to tackle complex issues and pave the way for scientifically sound policy decisions. In this connection, it is particularly urgent to initiate training programmes and institutional infrastructures that respond to sustainable development objectives and can provide support to the implementation of Agenda 21. The United Nations system should act as a catalyst for providing technical support to such innovative interdisciplinary capacity-building activities.

B. Enhancing international scientific cooperation

1. Strengthening existing international scientific programmes

70. Science related to environment and sustainable development needs, by definition, to be based both on national scientific programmes and activities and on international scientific cooperation. In many fields, such as ocean sciences, climate research, and research on the functioning of the Earth system and its carrying capacity, the generation of new knowledge is not possible without international scientific cooperation. And without this knowledge, as stated above, sustainable development cannot be achieved. Hence, it has become a strategic issue for Governments to support international scientific observation and research programmes.

71. National plans and investment in science should further global environment and developmental observing systems and should strengthen internationally coordinated scientific programmes on environment and development involving

relevant United Nations bodies and major international scientific bodies. Major emphasis should be given to national activities that contribute to global observation and research undertakings. Special efforts need to be made to increase the participation of developing countries and their scientists in international scientific undertakings in the field of environment and development.

72. The strategy followed to date in designing and implementing major international research and observation programmes has proved to be sound in principle and feasible in practice. This strategy is based on two principles:

(a) The programmes are based upon collaboration among the relevant United Nations bodies and one or more international scientific non-governmental organizations. In this way, scientific quality and objectivity, as well as policy-making relevance, is ensured.

(b) Scientists from participating countries design the international coordinating framework or research agenda together, in cooperation with a high-level international scientific steering committee. Nations then integrate the programme framework into their national research and observation activity. In this way, countries are part of coherent synergistic international programmes and networks that not only advance knowledge in the interests of all but also utilize more efficiently scarce human and financial resources, keeping duplication to a minimum.

73. For this strategy to work best, countries need to participate actively in the preparation of the framework (i.e., the observation and research agenda) as well as in its implementation.

2. Emerging issues for international scientific cooperation

74. Many subject areas related to environment and development have already significantly benefited from international scientific cooperation. However, there are several emerging interdisciplinary subject areas that are not yet adequately addressed by specific scientific programmes at the international level. Two of these areas were identified by the inter-agency consultation convened by UNESCO in its function as task manager for chapter 35 of Agenda 21: environmental economics and indigenous knowledge.

75. As to environmental economics, chapter 35 recognizes that increased international cooperation is needed for interdisciplinary research linking economics and the natural sciences. Chapter 2 refers to the development of economic theories linked to macroeconomic policies conducive to sustainable development, as well as to trade and debt issues in the context of environment and development.

76. Current methods for assessing different environmental values, such as option and existence values, are not yet universally agreed upon. International scientific cooperation is needed to develop the methodologies that will take into account different cultural and socio-economic situations. Other issues in environmental economics will also clearly require international scientific

cooperation, because national experiences have to be shared between countries and regions and will have to be adapted to suit national or regional needs and circumstances.

77. The range of issues at the interface of environment and economics, important in both industrialized as well as developing countries, and the scientific inputs necessary to address them, are too broad to be covered by any single institution. Cooperation between the international community, including the United Nations system, and universities, the private sector, research institutions, NGOs and Governments is essential.

78. Through centuries of living close to nature, indigenous or local peoples throughout the world have acquired an immense knowledge of their environment and its natural resources. Living in and on the richness and variety of complex ecosystems, they have an understanding of the properties of plants and animals, the functioning of ecosystems and the techniques for using and managing them that is particular and often detailed. In many developing countries, rural communities rely on locally occurring species for many - sometimes all - foods, medicines, fuel, building materials and other products. Equally, the knowledge and perception of the environment of local people and their relationship with it are often important elements of cultural identity.

79. Recent years have seen a growing appreciation of the existence of these two systems of knowledge for managing natural resources and the environment: one based on indigenous people's knowledge, and a second based on so-called western scientific knowledge. Using the two systems in a complementary fashion provides a powerful tool for achieving and managing sustainable development.

80. Indigenous knowledge received a great deal of attention during the preparations for UNCED and references to its importance are found in all the UNCED agreements, including the Convention on Biological Biodiversity and the Non-legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests, 6/ as well as in several chapters of Agenda 21. Within that perspective, several initiatives have taken shape over the last two or three years. They include the World Wide Fund for Nature (WWF)/UNESCO/Royal Botanic Gardens at Kew Initiative on People and Plants, which promotes ethnobotany and the sustainable and equitable use of plant resources. A number of projects within the World Decade of Cultural Development focus on the links between culture and resource use. Several FAO activities are rooted in local knowledge of natural resources, including its programmes on community forestry and on non-wood timber products. Traditional medicine is among the programmes of the World Health Organization (WHO). At the non-governmental level, the Indigenous Knowledge and Development Monitor produced by the Centre for International Research and Advisory Networks, serves as the international community of people who are interested in indigenous knowledge.

81. In terms of possible future action, Governments should take steps to record and apply indigenous knowledge in promoting participatory approaches to natural resources management and to the equitable and sustainable use of resources. Various bodies within the United Nations system should be encouraged to examine the current profile of indigenous knowledge in their programmes relating to

environment and development, and explore ways and means of reinforcing such profiles. Steps might also be taken for ensuring coordination of these activities and making better use of existing information, and for improving access to sources of information through such means as preparing various handbooks on particular subjects (e.g., ethnobotany) which could be subsequently made available on computerized networks and updated on a regular basis.

C. Improving communication of science

82. A critical but often neglected link in making effective use of science for sustainable development concerns communication. While science is indispensable for sustainable development, it can have an impact only if it is communicated to various non-specialist user groups in a language and form that can be understood and used.

83. At present there is a serious gap between the producers of scientific information and the users of such information, including policy makers, teachers, the media, non-governmental organizations, and other groups that play a major role in taking action towards sustainable development. The information on which decisions and actions are based is sometimes too sectoral to be relevant to complex real-world problems, out of date, partial to a particular geographical or cultural perspective, or driven by emotional reactions or interpretations.

84. What is needed is to ensure that the most recent and comprehensive information is collected, synthesized and made available in appropriate forms, depending on the particular needs of each target user group. The interpretation and language appropriate for a policy maker will differ from what is most effective for a teacher or for the general public.

85. In order to close this producer-user gap, the scientific and technological community needs to recognize that, for research to be used to solve the problems faced by society, the communication exercise described above must be considered an integral part of the research process. Scientists should be encouraged and indeed rewarded by their universities and research institutions to commit their time and energy to this communication work. At the same time, society needs to convey its requirements to the scientific community in order to mobilize the resources that science can bring towards finding solution to those problems.

86. Scientists need to work hand in hand with communicators, educators, journalists, and others who have the professional skills to assist in the effective transfer of technical information to non-specialist users of that information. Professional educators and communicators also need to take the initiatives of working with scientists to improve the content and relevance of their work concerning environment and development. Another need is the development of on-line information systems for various aspects of sustainable development (e.g., sustainable agriculture and rural development) in order to ensure easy access by managers and decision makers to high-quality and up-to-date scientific information.

87. Governments need to understand the importance of ensuring that scientific knowledge and information is tapped for decision-making. Governments should play an active role to help close the communication gap and to provide adequate financial support.

88. The need to address this communications challenge is also taken up in chapter 31 of Agenda 21, "Scientific and technological community" and chapter 36, Promoting education, public awareness and training.

D. Enhancing the application of science

89. Once new scientific information becomes available, it needs to be channelled quickly towards application by Government, industry and other economic sectors. To achieve this goal, close relationships must be fostered and, where absent, created between universities and research institutions on the one hand and business, industry and agriculture on the other. It is within the agricultural sector that such linkage has been developed most effectively so far. Extension services in some countries convey the results of agricultural research to farmers within one to three years.

90. Business and industry should strive to systematically absorb scientific findings. Success in this area can best be achieved through research undertaken on a collaborative basis between research universities, other research institutions and industry. Since sustainable development depends to a large extent on an evolutionary process of the world's "industrial metabolism", it is encouraging to note that in several branches of industry new opportunities for successful competition are being recognized. Science must support industry in its effort to design cleaner products and to devise cleaner production processes in response to environmental risks.

91. Intensive interaction and cooperation needs to be developed between national scientific, engineering and technology centres and institutions, on the one hand, and local and national industry on the other. In this vein, different types of partnership and cooperation between industry and universities need to be explored, including continuing education programmes for industry staff, industrial in-service training and apprenticeships for university students, consultancy services by universities and research institutions, research contracts to carry out research work on behalf of private or public-sector industries and the establishment of cooperative research centres. Such collaboration, which implies certain ethical rules and regulations, has become an integral part of the technological achievements of several regions in the world. This approach should be applied elsewhere in order to enhance science and technology in general and science for sustainable development in particular.

III. PROPOSALS FOR ACTION BY THE COMMISSION ON SUSTAINABLE DEVELOPMENT

92. The Commission on Sustainable Development may wish to consider the following proposals:

(a) Governments, with the support of international organizations, are encouraged to exchange information concerning the impact of the lack of scientific capacities and capabilities on achieving sustainable development objectives in developing countries, in particular the least developed countries, and to make this information available to the Commission;

(b) Governments of developed and developing countries, the United Nations system, and other relevant international organizations should accord high priority, including within cooperation and partnership arrangements, to specific activities aimed at enhancing the scientific capacities and capabilities of developing countries, e.g., through scientific education, enhancement of the status of science, improved integration of science in national development policies and plans, increased training in specialized fields and promoting interdisciplinary approaches;

(c) Governments that are members of COMSATS are encouraged to take efforts towards implementing the main objectives agreed upon by COMSATS, including:

(i) Providing political and economic support to major initiatives in capacity-building for science in the South;

(ii) Establishing a network of international centres of excellence in the south;

(d) Recognizing that in many scientific fields related to sustainable development, such as climate change, the human dimensions of global environmental change, the global hydrological cycle, the assessment of freshwater resources, and oceans and regional seas, the generation of new knowledge needs enhanced international scientific cooperation, Governments, international organizations and the scientific community should join efforts towards:

(i) Developing global environment and development observing systems;

(ii) Strengthening and, where necessary, expanding existing international scientific programmes to ensure coordination and high-quality science;

(iii) Increasing the participation of developing countries in these international scientific programmes;

(e) Governments, the industrial sector, and science and technology institutions, including universities, should enhance their cooperation at the national level as an effective way to strengthen both science for sustainable development and environmentally sound and sustainable economic - especially industrial - development;

(f) In addressing the need for increased financing to implement activities in the identified priority areas, in particular activities related to scientific capacity-building in developing countries, Governments of developed countries may consider:

(i) Increasing the amount of funds dedicated to the projects aimed at providing the scientific basis for the four portfolios of the Global Environment Facility;

(ii) Providing increased financial support to activities aimed at interdisciplinary training and the development of interdisciplinary research and development facilities, including in the context of the UNDP Capacity 21 programme;

(g) Governments of donor countries and multilateral and bilateral donor agencies should be encouraged to financially support:

(i) The International Fund For Technological Development of Africa, in order to support innovative programmes and projects intended to promote intensive interaction between scientific and engineering institutions and local industry in Africa;

(ii) The COMSATS Technical Assistance Fund for establishing a network of international centres of excellence in the South.

Notes

1/ United Nations Conference on Environment and Development in Rio de Janeiro, 3-14 June 1992, vol. I, Resolutions Adopted by the Conference (United Nations publication, Sales No. E.92.I.8 and corrigendum), resolution 1, annex II.

2/ See United Nations Environment Programme, Convention on Biological Diversity (Environmental Law and Institutions Programme Activity centre), June 1992.

3/ United Nations Framework Convention on Climate Change (A/AC.237/18 (Part II) and Add.1 and Add.1/Corr.1).

4/ United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (A/49/84/Add.2), annex, appendix II.

5/ Global Conference on the Sustainable Development of Small Island Developing States, Bridgetown, Barbados, 26 April-5 May 1994 (United Nations publication, Sales No. 94.I.8 and Corrigenda), resolution 1, annex II.

6/ United Nations Conference on Environment and Development ..., resolution 1, annex III.

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Transfer of environmentally sound technologies, cooperation and capacity-building

Report of the Secretary-General

SUMMARY

The present report covers the three priority areas identified by the Commission on Sustainable Development for which specific action is necessary: (a) access to and dissemination of information on environmentally sound technologies; (b) institutional development and capacity-building for managing technological change; and (c) financial and partnership arrangements. Emphasis is given to experiences gained and lessons learned by national Governments, international organizations and the private sector in implementing policies and programmes related to these priority areas. It is suggested that there is a need for the Commission to move forward in the development and implementation of a work programme on transfer of environmentally sound technology, cooperation and capacity-building that would encourage and support efforts at the national level to promote environmentally sound technologies for sustainable development.

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INTRODUCTION

1. At its second session, held from 16 to 27 May 1994 in New York, the Commission on Sustainable Development adopted a decision entitled "Transfer of environmentally sound technology, cooperation and capacity-building". 1/ In that decision, the Commission stressed the need for Governments of developed and developing countries and countries with economies in transition to take specific action in the following three interlinked priority areas:

(a) Access to and dissemination of information on environmentally sound technologies;

(b) Institutional development and capacity-building for managing technological change;

(c) Financial and partnership arrangements.

2. The present report focuses on these three areas, with emphasis on experiences gained and lessons learned by national Governments, international organizations and the private sector in implementing policies and programmes related to the development, transfer and diffusion of environmentally sound technologies (ESTs). Several policy recommendations are presented for each of the three priority areas.

3. Based on these recommendations, Elements of a work programme are presented composed of activities suggested for use at the country level by national Governments, and by (or with the support of) the United Nations system, other intergovernmental organizations and the private sector. To encourage and support national efforts to promote ESTs for sustainable development, the Commission will need to move forward in the development and implementation of a work programme on EST transfer, cooperation and capacity-building, with the objective of having it fully operational by 1997.

4. The preparation of this report benefited from inter-sessional meetings, including the OECD Workshop on Development Assistance and Technology Cooperation for Cleaner Production in Developing Countries (Hanover Workshop), Hanover, 28-30 September 1994; the Government of Poland's Third High-Level Advisory Seminar on Cleaner Production (Warsaw Seminar), Warsaw, 11-14 October 1994; the Workshop on Access to and Dissemination of Information on Environmentally Sound Technologies (Seoul Workshop), held by the Government of the Republic of Korea, Seoul, 30 November-2 December 1994; and a Round Table on Technology Transfer, Cooperation and Capacity-Building (Vienna Round Table), organized by the United Nations Industrial Development Organization (UNIDO), in cooperation with the United Nations Environment Programme (UNEP) and the Department for Policy Coordination and Sustainable Development of the United Nations Secretariat, Vienna, 6-8 February 1995.

5. Extensive use was made of information provided by Governments, the United Nations system and other intergovernmental organizations, as well as contributions submitted by the private sector and other major groups.

6. A "Compilation of information on policies and programmes of countries, international organizations and financial institutions to promote the transfer of environmentally sound technology, cooperation and capacity-building" is submitted as an addendum to this report. The purpose of this compilation is to provide, based on available information, an overview on initiatives being undertaken by countries, the United Nations system, other international organizations and the private sector to promote environmentally sound technology transfer, cooperation and capacity-building. The compilation is based on information submitted by national Governments to the Commission as well as on that provided by national and international organizations, financial institutions and the private sector. It also draws upon the contributions made available to the various inter-sessional meetings. The structure of the compilation resembles, in general, that of this report.

I. CURRENT SITUATION AND TRENDS RELATED TO THE TRANSFER OF ENVIRONMENTALLY SOUND TECHNOLOGIES

7. Technology transfer is a process involving the raising of awareness of the benefits of ESTs so as to create the demand for these technologies, the obtaining of information and the making of assessments of available and accessible technological options, and the implementing of technology selection and the managing of technological change. If any of these elements is omitted or seriously deficient, successful technology transfer will be difficult. The above implies transfer of hardware and services, of skills for operating and maintaining technology, and of technological capacity to adapt, incorporate and upgrade technology. 2/

8. Policies and programmes at the national and international levels to promote the development, transfer and diffusion of ESTs are increasingly being guided by two criteria: (a) a more reasonable balance between economic growth and environmental protection; and (b) a shift of focus from end-of-pipe technologies to cleaner production processes. In shifting to preventive approaches to environmental protection, many developed and developing countries and economies in transition have introduced or are considering cleaner production programmes.

Box 1. Environmental industry shift in focus

"Regulations, economics and common sense continue to shift the focus of the environmental industry more and more away from waste treatment and control to waste reduction and prevention. This broadening and redefinition of the industry is reflected by current corporate interest in concepts like strategic environmental management and 'industrial ecology', and the growing industrial focus on design for the environment (DFE) and design for disassembly (DFD) manufacturing techniques. We are witnessing a true sea change in industry's approach to the environment, and it will continue to reverberate through the commercial environmental industry for the next several years. In the process it will transform business as we know it. Many sectors of the original 'haul and dump' waste disposal business - the original environmental business - will be increasingly rendered a thing of the past as environmental practices evolve, giving rise to a new 'industry' focused more on recovery and prevention services."

Source: TechKNOWLEDGEy Strategic Group, 1994.

9. The quotation contained in box 1 implies a gradual change of focus regarding the demand for ESTs compared with other technologies, in general, and for cleaner production versus pollution control technologies, in particular. ESTs comprise both cleaner production technologies and pollution control technologies and both types are complementary technological solutions that have a role to play in moving towards more environment-friendly development.

10. In discussing the possible options for converting to cleaner production, the position of the pollution control technology industry in the market has to be considered. The Organisation for Economic Cooperation and Development (OECD) has estimated the size of the pollution control technology industry at US$ 200-300 billion per year. According to one OECD document, "in many cases, firms may invest in either end-of-pipe, pollution control and waste management technologies or cleaner production technologies. The demand for cleaner production technologies may be sharply limited by the relative advantages of the conventional and well-established pollution control technology industries over the emergent cleaner production technology industry". 3/ In addition, the Third High-Level Advisory Seminar on Cleaner Production noted that some existing macroeconomic policies (for example, subsidies, pricing of raw materials and energy) impede the demand for cleaner production and act as disincentives to its use. 4/

11. While the transfer of ESTs is effected primarily through private transactions, the scope and speed of this transfer are directly related to the creation of an "enabling" environment that is of common interest to all parties involved in the transfer process. It requires the setting up of a legal and economic framework with a practical system of environmental regulations, enforcement mechanisms and economic and fiscal incentives.

12. Although the main impact of policies has been through environmental regulations and standards, there has been a shift in focus towards policy

instruments, in particular economic instruments, incentives and voluntary agreements, that concentrate more on outcomes, and provide greater flexibility in achieving environmentally satisfactory solutions. This shift has been coupled with a greater emphasis on clean technologies and products. Both trends provide new impetus to the industry. 5/

13. The Vienna Round Table noted that the formulation of policy instruments, in particular economic instruments, could be a fruitful subject for international cooperation, in so far as there was a need to exchange experiences on the utilization of various policy instruments; that there was an overarching need to provide incentives to the transfer and deployment of ESTs as against the establishment of disincentives to environmental degradation; and that new concepts of quality management needed to be explored to promote the use of ESTs and management practices. 6/

14. Fostering investments in ESTs also requires the adoption of favourable policies for business development, and, in addition, the creation of a wider framework within which to encourage investments in the technological development process, including research, development and adaptation. According to OECD, in OECD member countries, for example, funds to promote cleaner technologies are being used to offset the costs and risks associated with the development/ demonstration phase of new technologies. This phase is where costs and risk are more significant and chances for technical failure much higher. Funds are also being used to support the practical implementation phase. Similar support programmes can be implemented in developing countries, often through development assistance programmes or joint ventures in the private sector. 7/

15. Changing production processes to cleaner production requires a much deeper understanding of the entire production process and of the technological systems involved. The issue for many developing countries may be access not so much to a particular technology as to the process of technological change. Capacity for handling the "software" part of the technology package has become a key requirement for successfully managing technological change. A more sophisticated level of training and education is needed at the enterprise level to understand the links among technology performance, competitiveness and environmental benefits. This will enhance the ability to adapt, maintain and upgrade new technologies. This can be realized best in the collaboration between technology suppliers and potential users. Technology cooperation and partnerships must focus on the management of technological change.

16. The role of the private sector in the development, transfer and diffusion of ESTs, the increase in research and development activities undertaken by the private sector, and the rapid expansion in foreign investments have been well recognized. In this regard, the potential role of transnational corporations (TNCs) in the transfer of ESTs has been highlighted. 8/

17. OECD has stated that the business sector has been increasing expenditures for environment goods and services, not only to respect environmental regulation but also to capture economic benefits from reducing consumption of raw materials and energy and reducing waste and pollution. Economic benefits and economic instruments are becoming the most important driving force to achieve environmental goals. More enterprises are perceiving the environment as a

scarce and strategic resource, increasing the benefits from investing in environmental management. 9/

Box 2. Initiatives of major groups

The World Business Council for Sustainable Development has established, in partnership with the United Nations Development Programme (UNDP), Sustainable Project Management (SPM), an autonomous non-for-profit association designed to develop and structure "eco-efficient" business projects that will contribute to sustainable development. SPM intends to have learning and demonstration effects by cooperating with business leaders in developing countries and economies in transition on ways to improve the efficiency of production processes in both environmental and economic terms.

The International Federation of Agricultural Producers (IFAP) has organized a regular dialogue among national farmers' organizations, agricultural research systems and extension institutions in Africa and Asia. It constituted an important basis in the search for sustainable farming systems that promote the use of indigenous knowledge and material, along with judicious and environment-friendly conservation.

World Wide Fund for Nature (WWF): The United States of America and WWF-Netherlands are helping WWF-India in a pilot programme on technology transfer to promote the reduction in emissions of greenhouse gases and stratospheric ozone-depleting substances. WWF's partners in this project are the Confederation of Indian Industry, the Tata Energy Research Institute and the Society for Development Alternatives.

Greenpeace publishes on a regular basis its Inventory of Toxic Technologies, an ongoing compilation of information about hazardous technologies that it believes should be phased out globally rather than transferred.

The Norwegian Society of Chartered Engineers assumes the responsibility for managing transfer of knowledge in waste minimization/cleaner production strategies, funded by the Norwegian Government, in Poland, the Czech Republic and Slovakia.

18. Business and industry have also made considerable progress in articulating their position on environmental technology cooperation and partnerships, and their readiness to engage in such activities. There are many business organizations dedicated to aspects of environmental management or to the environmental technology needs of a particular industry sector. International business networks for environmental technology cooperation, such as the Industry Cooperative for Ozone Layer Protection (ICOLP), are particularly successful when focused on specific industries or technologies. 10/

19. Governments of developed and developing countries and economies in transition have several avenues for promoting transfer of ESTs, cooperation and

capacity-building. The Hanover Workshop refers to some that are pertinent to national policies and strategies:

(a) Developed country Governments that are explicitly promoting cleaner technologies need to interact more closely with the private sector in their own and recipient countries;

(b) More donor agencies (both bi- and multilateral) need to include ESTs as an integral part of their technology cooperation and technical assistance programmes;

(c) Developing countries and countries with economies in transition could develop national programmes for using ESTs to foster cleaner production and products. This could amount to a business plan for deploying ESTs where they would contribute most to preventing pollution and wastes;

(d) These countries ought to create the demand for ESTs. This calls for setting an appropriate framework of policy and legal measures, and economic incentives to encourage the private sector to invest in ESTs.

II. ACCESS TO AND DISSEMINATION OF INFORMATION ON ENVIRONMENTALLY SOUND TECHNOLOGIES

20. The ability to obtain information on available technological alternatives is the first step towards making greater use of ESTs and upgrading systems of production. The experiences of UNEP and others show that the future widespread adoption of ESTs in developing countries and economies in transition will largely be an exercise in improved information exchange and capacity-building.

21. The adoption of a regulatory framework is an important precondition for the development and use of ESTs. The Seoul Workshop recognized that the adoption of environmental regulations or standards ought to be accompanied by the provision of economic incentives and capacity-building. It was also recognized that regulatory frameworks should consider local environmental problems and conditions. 11/

A. Information networks

22. The importance of country-based information access points that should be networked with other facilities for technology transfer such as centres for training, demonstration and transfer of ESTs has been recognized. However, since a large number of information channels (for example, chambers of commerce, industry associations, research centres, databases, national and international information systems) already exist, there should be strengthening of these channels rather than a creation of new ones.

23. A multiplicity of access points to information about ESTs is needed, provided those points are coordinated and networked to ensure efficient and cost-effective operations. Participants in the Seoul Workshop saw the need for

a consultative mechanism dedicated to enhancing cooperation and consistency between existing and emerging information systems.

24. There is a distinction between the information-delivery sources connected to legally binding international agreements and those not related to such agreements. Information systems established under legally binding international agreements (the Montreal Protocol on Substances that Deplete the Ozone Layer and the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal) are integral parts of a well-structured support mechanism. This is in contrast to Agenda 21, 12/ in which no specific support structures have been established to facilitate technology transfer. The importance of this distinction is illustrated by the UNEP Industry and Environment (IE) Office experience in operating the OzonAction Information Clearing-house (OAIC) and its International Cleaner Production Information Clearing-house (ICPIC).

25. The Parties to the Montreal Protocol recognized that successful phase-out of ozone-depleting substances would largely depend on the effective transfer of technology from developed to developing countries. The OzonAction Programme to facilitate technology transfer covers most of the steps required for effective functioning of OAIC. First, there is a clear need for the technology transfer to comply with a legally binding international agreement (the Montreal Protocol and its Amendments). Second, awareness of this need and development of national strategies are handled through country programmes. Third, there is an extensive effort to obtain and distribute, on a wide scale, information on the available technical options and sources of technologies, equipment and chemicals. Fourth, there is extensive training and networking to build local capacities for phasing out ozone-depleting substances. Fifth, and most important, there is financial support through the interim Multilateral Fund for the Implementation of the Montreal Protocol for information collection and dissemination, the development and use of country programmes, and the technology implementation process. 13/

26. ICPIC is an element of UNEP IE's Cleaner Production Programme. While cleaner production has been mentioned throughout Agenda 21 and international interest in this subject has been increasing, a more concerted effort was needed to translate this general level of interest into action. However, technology transfer under the Cleaner Production Programme is more difficult than under the OzonAction Programme. This is because there is no legal framework creating the demand for technology transfer and no special financial mechanism to provide support for national programmes. Therefore, the Cleaner Production Programme has embarked on a strategy of information exchange to create awareness of the need for cleaner production and, thereby, increase the demand for cleaner technologies. The key to successful implementation of this strategy is the existence of an effective information dissemination system providing relevant, timely and updated information; and, with this need in mind, ICPIC was developed. 14/

B. Requirements for successful information exchange

27. Information systems should be set up close to the end-users so as to: (a) ensure that end-users have knowledge of the existence of a given information source; (b) facilitate access by end-users; and (c) ease two-way information flow, that is, from the information source to local users, with feedback and lateral information exchange.

28. Both the systems for delivery and the information content must be based on user needs and capabilities. Therefore, knowledge of user needs is as important as the ability of the information user to know why technology is needed, what technological options are available and how to assess and apply an appropriate technology.

29. The Seoul Workshop emphasized that the information being provided about ESTs must accurately reflect the real needs of the users, that is to say the information must be demand-driven, not supply-driven. Changing regulatory environments, new technological developments and shifting economic imperatives all contribute to the modification of user needs. To ensure that EST information systems sufficiently address those needs, regular feedback mechanisms should be established by the EST information providers to gauge user requirements.

30. On the demand side, specificity of information is important, including a clear indication about the range of EST options available, their costs, how and where to get them, and a record showing the experience of other users. On the supply side, experiences and information are necessary concerning market opportunities in developing countries. 15/ Brokering services to make both partners aware of these opportunities should be provided.

31. The participants in the Seoul Workshop felt that technology suppliers, including multinational corporations, should be encouraged to learn about local needs and conditions in developing countries, and to actively seek partners there for joint ventures, licences and subsidiaries. Technology users should be informed about opportunities to adopt new ESTs and to share local EST innovation with foreign companies on mutually beneficial terms. Joint technology development should receive more emphasis in the future.

C. Information needs of small- and medium-sized enterprises (SMEs)

32. Small- and medium-sized enterprises (SMEs) are often neglected in technology transfer activities owing to a variety of factors such as (a) the sheer number of SMEs involved; (b) their relative lack of capital, knowledge and technical capacities to acquire new technologies; (c) the lack of well-organized SME industry associations; and (d) the difficulties for technology suppliers to identify, understand and contact SMEs. 16/

33. In assessing the current situation of SMEs, a study commissioned by UNIDO's Industrial and Technological Information Bank (INTIB) concluded that information provided on advanced technologies is mostly targeted at the developed countries

and not at the developing ones. Even where information systems target users in developing countries, these are cases either of large corporations, which may have advanced communication capabilities to handle information effectively, or of consultants and researchers at universities or research institutes. 17/

34. The recent "Report on the Review under Paragraph 8 of Article 5 of the Montreal Protocol" (see document UNEP/OZ.L.Pro/WG.1/11/4, p. ES-7) says that most large and many medium-sized enterprises are able to obtain specific information from the implementing agencies or from the vendors of chemicals and technologies. The lack of information on alternate technologies available to small and informal enterprises, however, has impeded phase-out of ozone-depleting substances.

35. Poor telecommunications in many developing countries and limited availability of computers in SMEs are physical and psychological barriers to effective information and technology transfer. Few information systems function by means of local contact points or with methods appropriate to local needs. Even fewer systems have recognized the educational role they must play in creating the market they intend to serve.

36. SMEs in developing countries often do not appreciate the value of information about ESTs. For companies with limited resources, information is costly in terms of both time and money. However, database owners are often not aware of the value to SMEs in developing countries of the information they hold. Since owners of SMEs in these countries rarely place monetary value on information, they are unattractive targets for commercially run information systems. 18/

37. Some case-studies presented by participants at the Seoul Workshop demonstrated that financing institutions usually favour large-scale investments, while transfer of technology often requires tailor-made, small-scale solutions, and pre-feasibility studies, such as energy efficiency studies and environmental audits. In this regard, sector-specific technology intermediaries may be useful in providing necessary investments. To succeed, an intermediary should focus its mission on one sector or technical area, identifying and acquiring rights to relevant technologies, locating potential users, facilitating licensing or investment arrangements, and providing management, technical and other advice. 19/

38. Promotional measures for information access and dissemination should have a strong focus on overcoming the information shortfall of SMEs, since large companies usually have their own information sources. INTIB's environmental information strategy for the next few years will specifically address the needs of SMEs in developing countries, while continuing a broader programme of information collection and dissemination.

39. Measures to facilitate and promote information flow to SMEs should be addressed to (a) technology suppliers, concerning knowledge of developing countries' needs and potential market opportunities and (b) technology buyers/recipients in developing countries, about the availability and appropriateness of technological solutions and services. Moreover,

demonstrations of technology applications under specific field conditions including on performance and maintenance requirements would be important.

D. Recommendations

40. Concrete measures should be taken to promote the exchange of information about ESTs and the capabilities of information users, with focus on SMEs, taking account of the recommendations contained in the Seoul Plan of Action. In this regard, the Commission on Sustainable Development may wish to consider the following proposals:

(a) The United Nations system, secretariats of the various conventions and other international organizations should consider appropriate action towards designing a "consultative mechanism" to enhance cooperation and compatibility between existing and projected information systems, for example, those operated by - or with the support of - the United Nations system, international conventions, non-governmental organizations or the private sector. The aim would be to make all interested partners aware of existing and planned information systems and to effect, to the extent possible, compatibility and interconnection between them. A first step in designing this consultative mechanism could be the preparation of a survey of existing information systems and sources related to ESTs. Such a survey has been initiated by UNEP;

(b) Governments, international organizations and the private sector should undertake efforts to enhance the exchange of information on the successful implementation of EST transfer operations, for example, through international workshops, dissemination of well-documented case-studies and networking activities. Cases should relate to the various "stages" in improving environmental performance, for example:

(i) Performing of environmental audits;

(ii) Better management control of the actions of existing plants ("good housekeeping");

(iii) Replacement of old equipment with the available pollution prevention technologies;

(iv) Development and introduction of new clean processes;

(v) Economic/financial benefits to be realized by use of ESTs.

III. INSTITUTIONAL DEVELOPMENT AND CAPACITY-BUILDING FOR MANAGING TECHNOLOGICAL CHANGE

41. Capacity-building, as discussed in this report, relates to creating the institutional climate and developing the human capabilities required to successfully implement the technology transfer process as a whole. Measures to be applied aim at organizational and institutional improvements, upgrading of technical and mechanical skills and build-up of the capabilities to understand and assess the performance of technologies in specific contexts. Improving capabilities for innovation by technology users and managing the incorporation of technologies in productive processes are also included.

A. Institutional factors

42. Three sets of factors may contribute to creating the institutional environment required to make technology transfer successful:

(a) Enabling conditions for technology development which would include:

(i) Technology progress considered as a national priority;

(ii) Institutional reforms made to eliminate disincentives to technology development;

(iii) Indigenous technology initiatives encouraged through market-related incentives to simplify commercialization of local products and processes;

(b) Strengthening the "technology triangle" as an effective mechanism for enhancing capacity-building. The technology triangle consists of strategic interactions between:

(i) Institutions of science and technology that generate knowledge and skills;

(ii) Business and industry that commercialize and use new technologies;

(iii) Government that sets regulations for directing technology advances.

Strengthening the linkages between these points of the technology triangle and creating incentives for cooperation greatly enhance technology development by consolidating national capabilities and linking public-private initiatives to a nation's intellectual and scientific capital; 20/

(c) Mechanisms to enhance North-South and South-South technology collaboration including:

(i) Joint initiatives to produce scientific inventions and innovations in technology frontier areas;

(ii) Professional and electronic networking to strengthen access to international technology information systems.

B. Promoting environmentally sound technology centres

43. Institution-building was recognized in inter-sessional meetings as an important element of the "enabling" environment to be created at the national level so as to promote the development, transfer and diffusion of ESTs. The participants in the Seoul Workshop emphasized the important role that environmentally sound technology centres (ESTCs), or their equivalent networks, could play in the promotion of ESTs. 21/ The discussion at the Vienna Round Table on institutional initiatives focused primarily on such concepts as cleaner production centres and ESTCs. 22/ The second session of the Open-Ended Ad Hoc Committee for the Implementation of the Basel Convention agreed to establish subregional centres for training and technology transfer on the environmentally sound management of hazardous wastes and the minimization of their generation in the Latin American and Caribbean regions (UNEP/BC/94/1).

44. The Seoul Workshop specified some operational terms and the functions that should be performed by the ESTCs or their equivalent networks: the promotion of ESTCs should build upon existing national institutions/organizations in countries, including research centres - centres, for example, established with the support of UNEP/UNIDO or of bilateral donors. The private sector must be directly involved in or connected with the ESTCs. The ESTCs should communicate with one another, and could also act as brokers to facilitate business operations. They should perform the following functions:

(a) Building awareness;

(b) Providing regular assessments of user needs;

(c) Training;

(d) Providing access to information from many sources;

(e) Initiating demonstration projects;

(f) Helping to identify financial resources;

(g) Helping to identify and obtain transfer of public domain ESTs. 23/

45. The Vienna Round Table built upon the conclusions of the Seoul Workshop. It was stressed that neither the term "cleaner production centre" nor the term "ESTC" signified a particular institutional structure; instead these could denote networks, national programmes or functions undertaken by different institutions. The key point made was that cleaner production efforts ought to be tailor-made, within the specificity of national institutional capabilities, industrial structures and environmental goals. Despite the need to have differentiated approaches, there were certain common ingredients that could be identified for cleaner production efforts. Building upon the functions identified by the Seoul Workshop, it was felt that, on a priority basis,

attention might be given to (a) training of trainers and advisers; (b) demonstration projects that highlighted the economic and environmental benefits of the use of ESTs and management skills; (c) awareness-building, inter alia, through dissemination of well-documented case-studies that clearly presented those economic benefits; and (d) capacity-building for technology assessment.

46. Regional cooperation was considered significant in the drive for cleaner production in terms of the following several elements: (a) the need to network centres so as to address transboundary environmental issues; (b) the need to develop training programmes; and (c) the need to effect sharing of experiences reflecting common problems. The networking of some centres within, and between, regions could enable the sharing of experiences among countries in the development and transfer of environmentally sound technologies.

47. Multilateral and bilateral efforts to support institutional networking would benefit from improved coordination. Such coordination could take several forms. For example, existing efforts in the field of industry could be linked with national or regional endeavours to implement international conventions such as the United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa (A/49/84/Add.2, annex, appendix II), and the Convention on the Ban of the Import into Africa and the Control of Transboundary Movements of Hazardous Wastes within Africa. Also, the efforts in one sector could benefit from the involvement of other United Nations organizations in order to develop intersectoral linkages. A specific example could lay within the possibilities for augmenting the UNIDO/UNEP national Cleaner Production Centres by associating capacity-building efforts by UNDP and the United Nations Educational, Scientific and Cultural Organization (UNESCO). The networking of some centres within, and between, regions could enable the addressing of transboundary environmental issues and the sharing of experiences of countries in the development and transfer of ESTs.

48. The Commission on Sustainable Development can play an important role in the coordination of bilateral and multilateral efforts to support institutional networking at the country level, with the objective of better enabling the utilization of expertise available in countries and international organizations or of developing approaches that have already been undertaken. Concrete proposals need to be worked out, also involving the secretariats of the various conventions. 24/ The proposals should be based on existing initiatives, such as the UNIDO/UNEP Cleaner Production Centres, which were designed to perform those functions identified in the Seoul Workshop and specified at the Vienna Round Table. ESTCs could provide an opportunity for coordinated donor support.

C. Training of human resources

49. Lack of skilled human resources on the side of the technology user, particularly in developing countries, has been recognized as producing a bottleneck in technology transfer. The lack of skilled staff grows acute as the process of technology generation, transfer and diffusion becomes increasingly complex.

50. Addressing this issue, an OECD publication noted that the skills required to use a particular technology effectively did not necessarily lead to the mastery of the skills required to change or adapt it. These capacities must be acquired through a conscious effort of "technological learning", and the investment of substantial resources. The buyer of technology must deliberately obtain the capabilities necessary to operate, maintain and adapt the technology. These capabilities were cumulative, not easily bought in the international markets and took considerable time to develop. The sellers of technology would increasingly need to offer long-term training packages to remain competitive. 25/

51. The 1994 UNEP IE Office Consultative Meeting with Industry/Trade Associations raised concern over the lack of environmental management capacities, in particular in SMEs. It concluded that for companies to operationalize sustainable development, training in environmental management was an indispensable requirement. Emphasis should be placed on supporting managers of companies, particularly of SMEs in developing countries, in building the necessary capabilities to put appropriate environmental management systems into practice. 26/ ESTCs could help in performing this task.

52. Existing educational and scientific structures are based largely on disciplinary or sectoral approaches. While training aimed at achieving excellence and skills in specific disciplines will continue to be a critical component of capacity-building, the kind of training that is disciplinary and sectoral must in the future be complemented by training that is of an increased and improved interdisciplinary and intersectoral type. Similarly, the development of institutions and their functioning should address the challenge of interdisciplinarity and the need to establish cross-sectoral linkages. UNESCO advocates an integrated approach that links (a) training of scientific and technical staff; (b) development of the appropriate institutions including high-quality learning institutions; and (c) promotion of a "scientific culture".

53. The Regional Centre for Graduate Study and Research in Agriculture (SEARCA) considers human resources training an important requirement equipping project managers and engineering staff with the skills needed for effective technology evaluation. It is also evident that training seminars and field demonstrations are important avenues of elucidation and persuasion concerning the benefits and risks, to technology end-users, involved in the application of certain technologies. 27/

D. Environmentally sound technology assessment

54. New technologies pose both opportunities and risks for the environment that need to be assessed before significant financial and social commitments are made. Environmental risk assessment is becoming an important element in the investment approval process of international development banks and other financial institutions. For example, International Finance Corporation engineers and environmental specialists support the transfer of ESTs as part of the project appraisal process. Every proposed investment is reviewed to ensure that the technology is environmentally sound. Technical assistance may be provided to the client in addressing any deficiency in project design.

55. Senior managers and account officers of banks, venture capital funds and leasing companies are encouraged to include evaluation of environmental performance as part of their normal credit review. As financial institutions pay increasing attention in investment or credit decisions to environmental performance of their clients, those clients will be motivated to use technologies that are environmentally sound. 28/

56. It is essential to build the user's capacities and capability to carry out assessments on how technologies to be introduced or transferred will act under specific conditions. Those assessments need to be sector- or project-specific. However, the development of basic criteria or general guidelines for the evaluation of environmental and safety performance could be important tools in transferring and applying ESTs. 29/ In the context of assessing technology options, the Vienna Round Table referred to environmental performance indicators (EPIs) that could be developed by Governments in consultation with industry and others concerned in order to establish commonly stressed targets and goals. 30/

57. Recognizing the importance of basic guidelines for the successful implementation of technology transfer, the Seoul Plan of Action proposed to develop and agree upon basic criteria and guidelines for evaluation of environmental and safety performance building upon already existing work. These guidelines should emphasize transfer of cleaner technologies. They might help the concerned parties in ensuring that the technologies were appropriate to the goals of sustainable development. The criteria and guidelines should also be used for private sector transfer. 31/

58. The feasibility study being carried out by UNEP IE's Environmental Technology Assessment (EnTA) Programme could provide a possible starting-point for developing such basic criteria or general guidelines. The Third High-Level Advisory Seminar on Cleaner Production recommended that UNEP should continue its initiatives to develop technology assessment methodologies and criteria for environmental technology assessment. 32/ The "Technical Guidelines for the Environmentally Sound Management of Wastes Subject to the Basel Convention" being prepared by the secretariat of the Basel Convention could also help (UNEP/94/3-SBC/94/5).

59. The general guidelines set forth the details of a process for clarifying the environmental implications of different technology choices. They are structured in such a way as to consider each party involved in technology transfer, outlining its responsibilities and indicating approaches to meeting them. They could take the form of a series of basic environmental questions to be asked about technologies, and approaches to answering the questions, and to identifying the information needed. This could be supplemented with basic references, and the listing of institutions involved in technology assessment, and of information sources. 33/

E. National needs assessment in support of environmentally sound technology transfer and capacity-building

60. The Commission on Sustainable Development, at its second session in 1994, recognized that assessment of needs for capacity-building and institutional development related to ESTs could be useful in enhancing development, deployment and transfer of those technologies. It was proposed that to benefit from the experiences gained from those exercises, the Commission should encourage developed and developing countries to jointly conduct case-studies on needs assessment at the national level (see document E/CN.17/1994/11, para. 36 (a)).

61. The European Commission intends to finance a joint European Commission/ Tunisia case-study on environmentally sound technology, applying the methodology adopted by the Commission on Sustainable Development's Inter-sessional Ad Hoc Open-Ended Working Group on Technology Transfer and Cooperation (see document E/CN.17/1994/11). The objective of the initiative is to help Tunisia in the development of the institutional and human capacities required to introduce environmentally sound technologies. Particular attention will be given to strengthening national capacities in (a) identification and evolution of Tunisia's technological needs; (b) acquisition of information on existing technologies; (c) selection and application of suitable technologies; and (d) appropriateness of transfer of technology on favourable terms. The study will also examine the possible role that the Eco-Technology Centre announced by the Tunisian authorities could play.

62. In Costa Rica, a national needs assessment study on ESTs is being supported by the Netherlands. The study covers the needs for national capacity-building in a broader sense (for example, in-the-field education, research, intermediary infrastructure, specific knowledge, enforcement of environmental regulations, cooperation between actors). The aim of the study is to supply Costa Rica with an effective tool for donor management. The Netherlands' support consists of the supply of financial means and expertise.

63. Switzerland and Pakistan will collaborate in a project that will identify the demand of Pakistan for EST in two industrial subsectors (possibly textiles and paper), and make concrete recommendations concerning (a) enhancing the capabilities to absorb environmentally sound technologies that are suitable to the conditions and the socio-economic and environmental requirements of the subsectors concerned; (b) involving local techniques, technologies and resources; and (c) promoting technology transfer, through partnerships between technology suppliers from Switzerland and potential users in Pakistan.

64. More experience is required on needs assessments for ESTs. There is also a need for exchanging the experience gained in current cooperation projects, in order to compare approaches and identify their respective strengths and weaknesses. Governments should provide the Commission on Sustainable Development with the appropriate information to enable the Commission to keep this issue under review.

F. Research and development

65. The existence of national research and development capacities in developing countries is critical to successful technology transfer and to the participation of these countries in international research and development cooperation. According to a report of the European Community, new growth theory suggests that technological progress and economic development are a function of accumulated investment in research and development and human capital, and that importing technology is not an alternative to indigenous research and development. In fact, the (European) Community has found that internal research and development is essential for efficient technology transfer. 34/

66. European Union evaluations of scientific and technological cooperation programmes with developing countries and countries in transition have highlighted their scientific quality and cost-effectiveness. The Union has learned a number of lessons from these programmes. These lessons, to be incorporated into the Union's future policies for cooperating with developing countries and countries in transition in research and technological development, involve the following: (a) the importance of mutuality in project planning and the implementation phase; (b) the need to base scientific cooperation on the priority needs identified in developing countries and countries in transition; also, the fact that without local/national support, investments in human capital, and scientific infrastructure are not sustainable; (c) the need to consider research priorities in relation to other policy areas such as development cooperation; (d) the fact that greater input from local scientists in developing countries and countries in transition is necessary from project formulation through to management, and an increase in the number of joint publications; and (e) the fact that the economic and environmental problems of sustainable development required an interdisciplinary approach. Building on local knowledge is vital to making research and its results relevant. 35/

G. Recommendations

67. Measures should be applied to improve the organizational and institutional environment, to upgrade technical and mechanical skills, to build up the capabilities to understand and assess the performance of technologies in specific contexts, and enhance innovation capabilities on the side of the technology user, and to manage the incorporation of technologies into productive processes. In this regard, the Commission on Sustainable Development may wish to consider the following proposals:

(a) Governments, the United Nations system, secretariats of the various conventions, other international organizations and the private sector should join in their efforts to enable countries to undertake the functions of ESTCs, or their equivalent networks, as identified in the Seoul Plan of Action, giving priority attention to:

(i) Training of trainers and advisers;

(ii) Demonstration projects that highlight the economic and environmental benefits of the use of ESTs and management skills;

(iii) Awareness-building, inter alia, through dissemination of well-documented case-studies that clearly present those economic benefits;

(iv) Capacity-building for technology assessment;

(b) The United Nations system, secretariats of the various conventions and other international organizations should join in their efforts to develop basic criteria and guidelines for environmentally sound technology assessment, building upon already existing work. These guidelines could emphasize transfer of cleaner technologies;

(c) Governments are invited to share experiences gained in conducting national needs assessments in support of EST transfer and capacity-building, and to make the results available to the Commission. There is also a need for exchanging experiences gained in current cooperation projects, in order to compare approaches and identify their respective strengths and weaknesses;

(d) Governments are encouraged to develop, in consultation with industry and others concerned, environmental performance indicators (EPIs) in order to establish commonly stressed targets and goals in the context of assessing technology options.

IV. FINANCIAL AND PARTNERSHIP ARRANGEMENTS

68. The rapid growth in demand for ESTs, particularly in developing, Eastern European and newly industrializing countries, opens up new opportunities for EST cooperation and partnerships. Expansion of the global operation of major firms, as they set up foreign operations to enter markets, and seek foreign partners to develop new technologies, may also advance the scope for EST cooperation and partnership arrangements. 36/

69. The need for enhanced North-South and South-South cooperation was recognized in the various inter-sessional meetings based on the fact that developing countries within a region, for example, face similar environmental concerns and are at equivalent levels of development. Two important mechanisms for these links are (a) joint research for problem-solving to assure that capacity-building measures are targeted at the frontiers of technology ("new" ideas and technologies) and to facilitate "leap-frogging", and (b) professional and electronic networking to strengthen access to international technology information systems.

70. With regard to South-South cooperation, it was stressed that it could potentially reduce costs of developing ESTs, thereby improving their viability. South-South cooperation could be, inter alia, enhanced via regional or subregional networking or by creating regional centres for research, training and technology transfer. This could, for example, enable a group of countries to link themselves to international research and development efforts. Constraints could be faced owing to the limited resources available to finance such cooperation. In order to mitigate these constraints, international organizations should support South-South cooperative efforts, particularly

through networking institutions in developing countries, as well as between institutions in developed countries and those in developing countries.

71. Initiatives should also be taken to integrate countries undergoing the process of transition into the system of global cooperation and partnerships in the areas of research and development, and transfer of ESTs. 37/

A. International capital flows 38/

72. In many developing countries and countries with economies in transition, the availability of private international capital has increased dramatically in recent years and is now substantial. Private sector flows have been targeted at the more industrialized developing countries, and thus correspond closely to those areas where the need for ESTs is greatest. In many of those countries, private sector flows now dominate official flows, particularly in terms of flows to the industrial sector. Furthermore, official flows are unlikely to grow rapidly, and have many other demands upon them (for example, poverty alleviation).

73. Direct public sector involvement in financing EST transfer is probably less effective than a policy and regulatory regime that clearly encourages or compels private companies to buy, sell and/or develop ESTs. This is owing to the fact that while directly intervening in the market-place may help to channel millions of dollars, or their equivalent, in favour of EST transfer, changing the very conditions under which business investment decisions are made has the potential to channel billions.

74. Over the period 1990-2020, developing countries are expected to increase their output from $9 trillion to $34 trillion - a nearly fourfold increase averaging about 4.5 per cent per year. For this increase of $25 trillion in output to occur, large amounts of capital will be needed. For example, Asian countries (other than Japan) plan to spend about $1 trillion on transport, communications, power generation and other infrastructure over the next 10 years. While most of the capital will come from domestic savings, McKinsey, the global consulting firm, estimates that the developing countries as a whole will need to import $2 trillion over the coming decade.

1. Foreign direct investment

75. According to the World Industry Council for the Environment (WICE), 39/ inbound foreign capital only accounts for some 3-4 per cent of total domestic capital formation in developing countries, the vast majority coming from domestic savings. Though small in financial terms, foreign capital plays a much larger role in terms of transferring skills, new technologies, new ideas and new management techniques.

76. Much foreign direct investment (FDI) is not directly oriented towards transferring ESTs to developing countries. In fact, some experts worry that FDI serves to transfer fewer environmentally sound technologies to developing countries as companies in more heavily regulated developed countries seek either

to sell off outmoded capital equipment and/or to shift production to jurisdictions with lower environmental standards. In recent years, however, these fears have become less justifiable for several reasons. First, many developing countries are raising their environmental standards and therefore are less willing to be a dumping ground for older, more polluting technologies. Second, larger foreign investors can no longer afford the risk of bad publicity that comes from poor environmental performance at any of their operations. Third, technological innovations are making ESTs more economically attractive and hence there are few, or fewer, advantages to be gained from using older, typically more polluting technologies.

2. Overseas portfolio investment

77. The World Institute for Development Economics Research expects that annual new portfolio investment in the developing countries will grow to $100 billion per annum by the end of this decade. Capitalization of emerging stock markets has leaped 10-fold since 1985 to $2.2 trillion in 1993 compared with $11 trillion for the industrialized economies. Even international bank lending is beginning to recover from the debt crisis of the 1980s.

78. There has been little research on the role of overseas portfolio investment in transferring ESTs to developing countries. Logically, the impacts either way are likely to be less clearly linked than they would be for foreign direct investment. A large amount of capital has been raised by developing country enterprises on the global capital markets to finance modernization and efficiency improvements that typically involve capital expenditure on ESTs. This is particularly so of privatized enterprises, including formerly State-owned utilities.

79. While overseas portfolio investment finances the modernization of former State-owned enterprises, much of it also flows into large privately-owned companies operating in natural resource sectors. There is considerable concern among environmental non-governmental organizations that portfolio flows into these companies are doing harm because they facilitate the rapid exploitation of natural resources without any environmental safeguards.

3. Privatization

80. Privatization of public enterprises is a major feature of the economic restructuring of the developing countries and transitional economies. The development banks, lead by the World Bank, are supporting privatization through policy and project lending and also technical assistance. Many privatization candidates leave behind significant environmental risks or "pollution stocks". Furthermore, many candidates may be the source of continuing "pollution flow" problems or could be drawing down stocks of natural resources at an alarming rate. Privatization may therefore recapitalize and revive polluting firms that would otherwise go out of business.

81. Privatization can also produce positive environmental effects, such as increased efficiency in the use of natural resources and more rapid adoption of

ESTs. At present, the World Bank advises many Governments to assume responsibility for most or all damages or hazards resulting from past practices, thus providing the new owner with a "clean slate". On the other hand, many private investors insist on special concessions such as reductions in price and indemnification, while others are willing to undertake cleanup if reimbursed from purchase funds.

82. There is considerable scope for incorporating EST criteria into the structuring, negotiating and financing of privatization programmes and tenders. Rather than awarding tenders to the highest purchaser or to the bid that offers the lowest cost of service provision, Governments could weight decisions with EST investments and environmental improvements in mind. This might also help to overcome political obstacles where foreign ownership is an issue. Turning this idea into practice will generally require significant technical assistance from donors. Leverage over policy makers might be enhanced or backed up by lending operations.

B. Public-private partnerships

83. Often an effective way to accelerate the financing of EST transfer is by public-private partnership. The public sector involvement, including that of international aid agencies and development banks, in such partnerships can be justified based on four main reasons:

(a) There is often a need to mitigate political and commercial risks, be they perceived or actual, so as to unlock private capital and technology flows;

(b) There is often a need to show that EST technologies deliver real, cost-effective benefits to the end-user before these technologies can be widely diffused using market mechanisms;

(c) There may be a need for financial innovation for EST transfer that, at least initially, requires public sector leadership;

(d) Some ESTs might not be competitive with alternatives from a business standpoint but their transfer should be subsidized for public interest reasons.

84. Where Governments, or the international organizations they finance, join with the private sector to transfer ESTs, it is typically with the hope or expectation that the private sector will be willing and able to undertake the transfer process without public sector involvement in the longer run. In the shorter term, the aim of public-private partnerships is to lever public resources to mobilize private capital and harness market forces as much as possible.

85. The higher the perceived, if not actual, risks of investing in developing countries, the shorter the time-horizons of investors and lenders and the higher their expected rates of return. As a result, many EST investments can seem unattractive to private investors. Public-private sector partnerships can therefore be created that reduce risks in order to lengthen maturities and reduce the price of capital.

86. Evidently, there is a small but growing number of public-private financial mechanisms supported by aid agencies that are aimed at the development and diffusion of ESTs. These initiatives are encouraging because they represent more than additional capital: they represent innovative models in themselves. They also represent an opportunity to show that EST investments increase the competitiveness of companies that invest. Nevertheless, the funds currently being mobilized for EST investments in the developing countries come nowhere near meeting the potential demand for such investments.

87. Several types of innovative partnerships have been identified in the various inter-sessional meetings and the material provided by Governments, international organizations and the private sector.

1. Technological and financial intermediaries

88. One important category of partnership is the publicly funded intermediary for EST transfer. It aims to help in the development of projects oriented towards transferring ESTs, through providing pre-investment support, such as funding of feasibility studies, finding of partners and preparing of bankable proposals, thus enabling the mobilization of private capital.

89. In examining two models of technological intermediaries being developed in the Asian context, the Vienna Round Table concluded that more analysis would be needed of cases of successful technology intermediaries, and that case-studies needed to be provided to the international community at large, in order to facilitate the emulation of such initiatives. Furthermore, given the chain of events required to implement technological change, the role of these intermediaries is considered vital to the adoption of ESTs, especially to SMEs.

90. As regards financial intermediation, there was a general recognition that the lending practices of the private sector and of development finance institutions did not readily support the required investment in cleaner production and ESTs. In many cases, such investments are incremental in nature and of a relatively small amount. Capacity-building efforts are needed to enable entrepreneurs to prepare bankable projects. In addition, investigations could be made, at the national level, to ascertain whether lending practices could be made more flexible so as to be able to entertain the possibility of a demand for financing the investment needs identified through cleaner production programmes. 40/

2. Build-Operate-Transfer (BOT) arrangements 41/

91. Build-Operate-Transfer (BOT) arrangements have been used by several countries as an alternative to foreign borrowing or investment from the public budget for the development of infrastructure. The importance of BOT arrangements to sustainable development arises from its potential for infrastructure investments in such areas as power and water-supply systems. In 1993, estimates show that globally, some 400 BOT projects were under consideration in the power, transportation and water sectors, at an aggregate

value of about US$ 430 billion. In negotiating BOT arrangements, it would be important to ensure that environmental objectives are fully incorporated.

Advantages of BOT arrangements:

(a) Use of private sector financing to provide new sources of capital, which reduces public borrowing and direct spending, and which may improve the host Government's credit rating;

(b) Ability to accelerate development of projects that would otherwise have to await, and compete for, limited external resources;

(c) Use of private sector capital, initiative and know-how to reduce project construction cost and schedules and to improve operating efficiency;

(d) Allocation of such project risk and burden to the private sector as would otherwise have to be undertaken by the public sector;

(e) Sponsors' incentives and risks as well as involvement of experienced commercial lenders providing in-depth review and additional assurance of project feasibility;

(f) Technology transfer and local capability-building, encouragement in the development of national capital markets and other substantial derivative benefits realizable from BOT projects;

(g) Possibility for Governments to build environmental impact and environmental performance parameters into the design and operation of the projects.

Drawbacks of BOT arrangements:

(a) The application of the BOT concept is a complicated undertaking compared with conventional financing of public sector projects and has been fraught with many difficulties. Although many BOT projects have been proposed and advertised, relatively few projects have actually been implemented;

(b) The outcome of BOT negotiations is often in doubt, partly because criteria and standard solutions on important issues have been slow to develop. Project studies and proposals that are not properly prepared have resulted in increased costs, delays and frustrations. Divergent positions on costs of construction, equipment and financing have caused difficulties and protracted negotiations. The need to work out pragmatic risk reward and security structures has not always been properly managed so as to attract investors. Lack of authority or lack of legislation has delayed negotiations for so long that projects have been abandoned. The legislation and regulations needed to streamline the implementation of BOT projects do not exist in most countries;

(c) BOT projects are complex from both a financial and a legal point of view. They require time to develop and negotiate. They require committed host Government involvement and support. Fortunately, with the benefit of the experience of the last decade, the basic structure needed to make a BOT project

viable is now better understood. Standard solutions are being worked out, so that many of the problems that seemed to be insurmountable are now being resolved. While any particular government agency may be low on the BOT learning-curve, the learning does exist and is available through private advisers and international organizations;

(d) A BOT project is very much a public-private partnership. It is first necessary for the Government to establish a rational process for the identification of suitable projects and the selection of bidders. The bidding procedures for BOT projects require some modification from conventional procedures. To fit the need for optimal technology transfer, flexibility in procurement and transparency in the entire process of developing and implementing the project are required. The availability of necessary government approvals, direction and support is critical to successful BOT projects.

3. The "technology triangle" concept

92. The "technology triangle" concept defines a public-private partnership that functions on the basis of strategic interaction and collaboration among government agencies and institutions, the private sector and institutions of science and technology. The objective is to stimulate the development, transfer and diffusion of ESTs through collaborative partnerships and capacity-building.

93. An example of successful action for strengthening the concept of the technology triangle as an internal partnership is evident from the status of environmental technology in the Netherlands. That success is due to the cooperation among the Government, industry, technological institutes and universities. One way in which the Netherlands Government is stimulating the development and application of environmental technology is through a special action programme, which devotes considerable attention to research on environmental technology. An example of this is the Innovative Research Programme for Environmental Technology (IOP). This programme is aimed at strengthening research on environmental technology at universities and technology institutes that study environmental biotechnology, recycling or waste prevention.

94. An example of an external technology partnership leading to the consolidation of a technology triangle internationally is the "Private-Public Partnerships for Urban Environments", an initiative of three institutions: the United Nations Development Programme (UNDP) (public sector), the Sustainable Project Management of the World Business Council for Sustainable Development (private sector), and the Technology and Development Program of the Massachusetts Institute of Technology (science and technology). This collaboration is supported by action at two levels: "horizontal" or international collaboration between three key sets of actors; and "vertical" linkages between each of these three actors and their respective constituencies within countries throughout the developing world. 42/

4. Environmentally sound technology venture capital funds

95. Another example of public-private partnerships is publicly sponsored investment funds with a focus on ESTs. Venture capital funds are particularly significant here. While the total amount involved so far is small, the potential leverage of these funds, and their effectiveness in transferring ESTs, are large.

5. Environmentally sound technology "guarantees"

96. To accelerate technological change and to encourage technology leap-frogging, the development of "technology guarantees" should be considered. Through such guarantees, a financially strong third party guarantees the performance of new ESTs. The rationale for such guarantees is that even after successful demonstration of technology, and full technology assessment, private capital markets can still require more time before they regard a technology as proved. This can impose a delay on the uptake of new technology, especially those with a long life.

6. Leasing arrangements

97. Leasing has many advantages, especially for SMEs: it is packaged, off-balance sheet and readily available. There is substantial scope for developing leasing facilities in the area of ESTs. The key attribute of leasing is that initial arrangements are made with the seller of the technology, whereby he or she agrees to support sales of his or her technology (rather than finance the purchaser). Ultimately leasing should evolve to become a private sector function. Initially it may need encouragement through public/private partnerships.

C. Recommendations

98. Successful technology transfer and management of technological change can best be realized in collaboration between technology suppliers and potential users. The Commission may wish to consider the following proposals:

(a) Financial markets should be encouraged to support ESTs. Particular measures would include:

(i) In banking, moving beyond liability-based Environmental Impact Assessments to broader assessments encompassing the potential for EST;

(ii) In capital markets, making information available on environmental performance (for example, resource use, waste produced), through stock market listings and annual reports, so as to make the cost advantages of ESTs transparent;

(iii) In fund management (including pensions management), making fund managers aware of the strategic investment advantages from ESTs;

(iv) In privatization, encouraging the use of EST criteria in tendering programmes.

The development banks, through their support of financial sector reforms, are probably best positioned to encourage these changes. In some cases, they would need to start by altering their own investment practices;

(b) Governments should be invited to take measures towards increasing the amount of external investment through, for example:

(i) Internalization of environmental costs within competitive markets;

(ii) Examination of the framework of laws and incentives that affect technology cooperation;

(iii) Compensation, in some cases, for risks perceived by foreign investors, for example, by way of guarantee schemes or soft loan contributions provided by Governments;

(c) Governments should take initiatives to enhance South-South cooperation, for example, through support for:

(i) Joint research for problem-solving to assure that capacity-building measures are targeted at the frontiers of technologies and to facilitate leap-frogging;

(ii) Networking among research institutes in developing countries;

(iii) Regional centres that play a role in information exchange and training for capacity-building;

(iv) Networking with international organizations;

(d) Governments, international organizations and the private sector should support the preparation and dissemination of case-studies on experiences gained in using intermediaries in the transfer and application of ESTs, in order to facilitate the replication of successful examples;

(e) Pilot projects should be conducted on the practicability of BOTs for promoting EST transfer, including building the capacities of developing countries and economies in transition to negotiate BOT contracts;

(f) Governments should be encouraged to strengthen the technology triangle at the national level, and to develop and utilize a similar approach at the international level.

V. ELEMENTS OF A WORK PROGRAMME FOR THE PROMOTION OF ENVIRONMENTALLY SOUND TECHNOLOGY TRANSFER, COOPERATION AND CAPACITY-BUILDING

99. The elements contained in this work programme are drawn from the recommendations listed at the end of each of the preceding sections of the report. These recommendations resulted from the various inter-sessional meetings referred to in the introduction to the report and throughout the text.

100. These inter-sessional meetings emphasized the coordinating role of the Commission on Sustainable Development within the United Nations system for activities related to the promotion of EST transfer, cooperation and capacity-building. They also affirmed the need for the Commission to move forward in the development and implementation of a programme of work on EST transfer, cooperation and capacity-building, with the objective of having it fully operational by 1997.

101. The Elements of a work programme, as presented in this report, are meant to be a point for departure of the discussion of the Commission on such a work programme.

A. National policies to promote the transfer of environmentally sound technologies (ESTs), cooperation and capacity-building

102. Policies and strategies need to be developed and implemented by national Governments to promote the development, transfer and diffusion of ESTs, including for the accelerated implementation of cleaner production programmes. Accordingly:

(a) Governments of developed countries are encouraged to include ESTs as an integral part of their technology cooperation and technical assistance programmes;

(b) Governments of developing countries and economies in transition are encouraged to develop sector-specific policies and programmes for using ESTs, in particular to promote cleaner production and products;

(c) Governments, in cooperation with international organizations, should enhance the exchange of experiences gained on the impact and effectiveness of economic instruments on the development, transfer and use of ESTs, through, for instance, international workshops and the dissemination of well-documented case-studies. The analysis of economic instruments should be on a sector-specific basis.

B. Access to and dissemination of information on environmentally sound technologies

103. Concrete measures should be taken to promote the exchange of information about ESTs and the capabilities of information users, with focus on SMEs, taking account of the recommendations contained in the Seoul Plan of Action. In this regard, the Commission may wish to consider the following proposals:

(a) The United Nations system, secretariats of the various conventions, and other international organizations should consider appropriate action towards designing a "consultative mechanism" to enhance cooperation and compatibility between existing and projected information systems, for example, those operated by - or with the support of - the United Nations system, international conventions, non-governmental organizations or the private sector. The aim would be that all interested partners should be aware of existing and planned information systems and that there should be, to the extent possible, compatibility and interconnection among them. A first step in designing this consultative mechanism could be the preparation of a survey of existing information systems and sources related to ESTs. Such a survey has been initiated by UNEP;

(b) Governments, international organizations and the private sector should undertake efforts to enhance the exchange of information on the successful implementation of EST transfer operations, for example, through international workshops, dissemination of well-documented case-studies, and networking activities. Cases should relate to the various "stages" in improving environmental performance, for example:

(i) Performing of environmental audits;

(ii) Better management control of actions of existing plants ("good housekeeping");

(iii) Replacement of old equipment with the available pollution prevention technologies;

(iv) Development and introduction of new clean processes;

(v) Realization by use of ESTs, of economic/financial benefits.

C. Institutional development and capacity-building for managing technological change

104. Measures should be applied to improve the organizational and institutional environment, upgrade technical and mechanical skills, build up the capabilities to understand and assess the performance of technologies in specific contexts, and enhance innovation capabilities on the side of the technology user, and to manage the incorporation of technologies within productive processes. In this regard, the Commission may wish to consider the following proposals:

(a) Governments, the United Nations system, secretariats of the various conventions, other international organizations and the private sector should join in their efforts to enable countries to take upon themselves the functions of ESTCs, or their equivalent networks, as identified in the Seoul Plan of Action, giving priority attention to:

(i) Training of trainers and advisers;

(ii) Demonstration projects that highlight the economic and environmental benefits of the use of ESTs and management skills;

(iii) Awareness-building, inter alia, through dissemination of well-documented case-studies that clearly present those economic benefits;

(iv) Capacity-building for technology assessment;

(b) The United Nations system, secretariats of the various conventions and other international organizations should join in their efforts to develop basic criteria and guidelines for environmentally sound technology assessment, building upon already existing work. These guidelines could emphasize transfer of cleaner technologies;

(c) Governments should be invited to share experiences gained in conducting national needs assessments in support of EST transfer and capacity-building, and to make the results available to the Commission. There is also a need for exchanging experiences gained in current cooperation projects, in order to compare approaches and identify their respective strengths and weaknesses;

(d) Governments should be encouraged to develop, in consultation with industry and others concerned, environmental performance indicators (EPIs) in order to establish commonly stressed targets and goals within the context of assessing technology options.

D. Financial and partnership arrangements

105. Successful technology transfer and management of technological change can best be realized through collaboration between technology suppliers and potential users. The Commission may wish to consider the following proposals:

(a) Financial markets should be encouraged to support ESTs. Particular measures would include:

(i) In banking, moving beyond liability-based Environmental Impact Assessments to broader assessments encompassing the potential for EST;

(ii) In capital markets, making information available on environmental performance (for example, resource use, waste produced), through stock market listings and annual reports, so as to make the cost advantages of ESTs transparent;

(iii) In fund management (including pensions management), making fund managers aware of the strategic investment advantages from ESTs;

(iv) In privatization, encouraging the use of EST criteria in tendering programmes.

The development banks, through their support of financial sector reforms, are probably best positioned to encourage these changes. In some cases, they would need to start by altering their own investment practices;

(b) Governments should be invited to take measures towards increasing the amount of external investment through, for example:

(i) Internalization of environmental costs within competitive markets;

(ii) Examination of the framework of laws and incentives that affect technology cooperation;

(iii) Compensation, in some cases, for risks perceived by foreign investors, for example, by way of guarantee schemes or soft loan contributions provided by Governments;

(c) Governments should take initiatives to enhance South-South cooperation, for example, through support for:

(i) Joint research for problem-solving to assure that capacity-building measures are targeted at the frontiers of technologies and to facilitate leap-frogging;

(ii) Networking among research institutes in developing countries;

(iii) Regional centres that play a role in information exchange and training for capacity-building;

(iv) Networking with international organizations;

(d) Governments, international organizations and the private sector should support the preparation and dissemination of case-studies on experiences gained in using intermediaries in the transfer and application of ESTs, in order to facilitate the replication of successful examples;

(e) Pilot projects should be conducted on the practicability of BOTs for promoting EST transfer, including building the capacities of developing countries and economies in transition to negotiate BOT contracts;

(f) Governments should be encouraged to strengthen the technology triangle at the national level, and to develop and utilize a similar approach at the international level. The concept of the technology triangle concern a public-private partnership that functions on the basis of strategic interaction and collaboration among government agencies and institutions, the private sector and institutions of science and technology. The objective is to stimulate the

development, transfer and diffusion of ESTs through collaborative partnerships and capacity-building.

Notes

1/ See document E/1994/33, chap. I, sect. C.

2/ "Lessons learned from the three information exchange networks to facilitate technology transfer", UNEP IE contribution submitted to the Workshop on the Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies, hosted by the Government of the Republic of Korea, 30 November-2 December 1994.

3/ OECD secretariat, Background paper, Meeting of Experts on the Environment Industry (Paris, France, 13-14 October 1994), p. 22.

4/ Draft summary report, Third High-Level Advisory Seminar on Cleaner Production (Warsaw, Poland, 12-14 October 1994), p. 4.

5/ OECD, "The environment industry: issues for discussion", Directorate for Science, Technology and Industry, Industry Committee (Paris, France, 7 September 1994), p. 4.

6/ Chairman's summary, Round Table on the Transfer of Environmentally Sound Technology, Cooperation and Capacity-Building (Vienna, Austria, 6-8 February 1995), p. 3.

7/ "Transfer of environmentally sound technology, cooperation and capacity-building (informal submission from the OECD secretariat, Paris, France, 8 November 1994), p. 5.

8/ This observation is based on the contribution submitted by the United Nations Conference on Trade and Development (UNCTAD), Geneva, Switzerland, 15 December 1994.

9/ Background paper, Meeting of Experts on the Environment Industry, OECD secretariat (Paris, France, 13-14 October 1994), p. 22.

10/ Conference summary: International Business and Environmental Technology Cooperation (Washington, D.C., Center for Strategic and International Studies, 24 and 25 January 1994), p. 2 ff.

11/ Chairman's summary, Workshop on the Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies (Seoul, Republic of Korea, 30 November-2 December 1994), p. 1.

12/ Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992, vol. I, Resolutions Adopted by the Conference (United Nations publication, Sales No. E.93.I.8 and corrigendum), resolution 1, annex II.

13/ "Lessons learned from the three information exchange networks to facilitate technology transfer", UNEP IE contribution submitted to the Workshop on the Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies, hosted by the Government of the Republic of Korea, 30 November-2 December 1994, p. 10 ff.

14/ Ibid., p. 23.

15/ OECD Workshop on Development Assistance and Technology Cooperation for Cleaner Production in Developing Countries, Hanover, Germany, 28-30 September 1994.

16/ "Proposed actions to promote the adoption of environmentally sound technologies through improved information exchange", prepared by UNEP Industry and Environment for the Workshop on the Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies (Seoul, Korea, 30 November-2 December 1994), Paris, France, 25 November 1994, p. 3.

17/ "Proposal for Seoul plan of action, focus on small- and medium-scale industry (SMI)", UNIDO contribution to the Workshop on the Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies (Seoul, Republic of Korea, 30 November-2 December 1994).

18/ Ibid.

19/ George R. Heaton, R. Darryl Banks, Jr. and Darryl D. Ditz, Missing Links: Technology and Environmental Improvement in the Industrializing World (Washington, D.C., World Resource Institute, 1994), p. xi.

20/ Based on information submitted by the Technology and Development Programme of the Massachusetts Institute of Technology (MIT) (Boston, Massachusetts, November 1994).

21/ Chairman's summary and Seoul Plan of Action concerning Information Exchange about Environmentally Sound Technologies, Workshop on the Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies (Seoul, Republic of Korea, 30 November-2 December 1994).

22/ Chairman's summary and Elements of a Work Programme on Environmentally Sound Technology Transfer, Cooperation and Capacity-Building, Round Table on the Transfer of Environmentally Sound Technology, Cooperation and Capacity-Building (Vienna, Austria, 6-8 February 1995).

23/ Seoul Plan of Action concerning Information Exchange about Environmentally Sound Technologies, Workshop on the Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies (Seoul, Republic of Korea, 30 November-2 December 1994).

24/ Chairman's summary and Elements of a Work Programme on Environmentally Sound Technology Transfer, Cooperation and Capacity-Building, Round Table on the Transfer of Environmentally Sound Technology, Cooperation and Capacity-Building (Vienna, Austria, 6-8 February 1995).

25/ OECD, Development Assistance Committee (DAC), "Effective technology transfer, cooperation and capacity-building for sustainable development: common reference paper" (OECD/GD/(94)12), 1994, p. 8.

26/ UNEP/IE, "Draft summary report", 1994 UNEP/IE Consultative Meeting with Industry/Trade Associations (Paris, France, 17 June 1994).

27/ Based on information submitted by the Regional Centre for Graduate Study and Research in Agriculture (SEARCA), 11 October 1994.

28/ Contribution submitted by the International Finance Corporation/World Bank Group (New York, 23 February 1995), p. 1.

29/ "Lessons learned from the three information exchange networks to facilitate technology transfer", UNEP IE contribution submitted to the Workshop on the Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies, Seoul, Republic of Korea, 30 November-2 December 1994.

30/ Chairman's summary, Round Table on the Transfer of Environmentally Sound Technology, Cooperation and Capacity-Building (Vienna, Austria, 6-8 February 1995), p. 3, para. 9.

31/ Seoul Plan of Action, adopted at the Workshop on Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies (Seoul, Republic of Korea, 30 November-2 December 1994), p. 3.

32/ Draft summary report, Third High-Level Advisory Seminar on Cleaner Production (Warsaw, Poland, 12-14 October 1994), p. 3.

33/ "Lessons learned form the three information exchange systems to facilitate technology transfer", contribution of UNEP IE to the Seoul Workshop (30 November-2 December 1994), p. 33.

34/ "On progress towards implementation of Agenda 21", report of the European Community submitted to the Commission on Sustainable Development, at its third session, April 1995, p. 12.

35/ Ibid., p. 13.

36/ OECD Directorate for Science, Technology and Industry, "Forum discussion on the environment industry" (Paris, France, OECD Industry Committee, 1 September 1994), p. 22, paras. 75-76.

37/ Chairman's summary and Elements of a Work Programme on Environmentally Sound Technology Transfer, Cooperation and Capacity-Building, Round Table on the Transfer of Environmentally Sound Technology, Cooperation and Capacity-Building (Vienna, Austria, 6-8 February 1995).

38/ Based on information prepared by the Delphi Group, on "Financing the transfer of environmentally sound technology", for the inter-sessional Ad Hoc Open-ended Working Group on Finance (1995).

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40/ Chairman's summary and Elements of a Work Programme on Environmentally Sound Technology Transfer, Cooperation and Capacity-Building, Round Table on Environmentally Sound Technology, Cooperation and Capacity-Building (Vienna, Austria, 6-8 February 1995).

41/ This section is based on information excerpted from BOT Strategy. UNIDO Programme on Build-Operate-Transfer (Vienna, Austria, UNIDO, 1994).

42/ Private-Public Partnerships for Urban Environments, an initiative of UNDP, the Sustainable Project Management of the World Business Council for Sustainable Development and the Technology Development Program of the Massachusetts Institute of Technology (New York, UNDP, 1995).